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This study tests the following hypotheses concerning the job creativity of managers: (1) There is a significant relationship between psychological test scores secured on subjects 15 to 20 years ago and creative performance on the job today. (2) there is a significant relationship between biographical information secured from subjects at the time of the study and creative performance on the job today. The subjects were 143 graduating chemical engineers at the North Carolina State University from 1947 to 1951 who were administered a battery of tests It is concluded that past performance and self-appraisal of one's own creativity are fairly good predictors of creative managerial performance A review of the literature and a 94-item bibliography are included. (HW)

A PREDICTIVE VALIDITY STUDY OF CREATIVE AND EFFECTIVE MANAGERIAL PERFORMANCE

by

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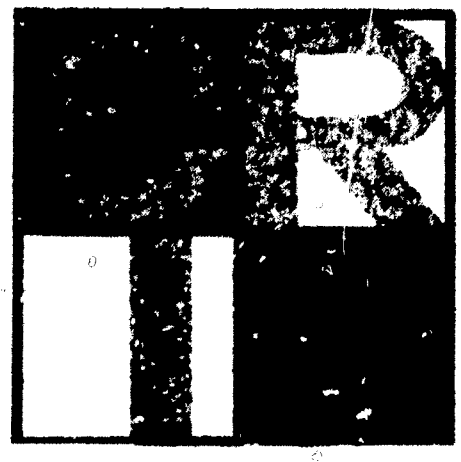

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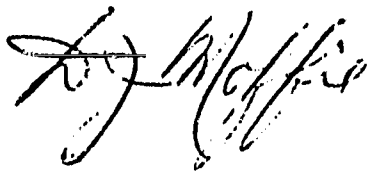
D. J. Moffie



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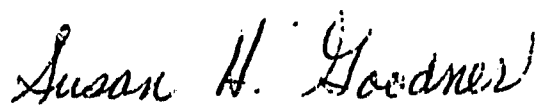

INTRODUCTION:

It is a well known psychological fact that the best predictor of future performance is the past performance of the individual. This has been verified in the fields of industry, business, and education. Generally, in the prediction of college success, high school rank carries major weight in the prediction equation. Psychologists when assessing sales personnel point out that the past performance of the individual is important in the prediction of his success.

The validation of psychological tests generally follows either one of two paths: (1) a validation based on present assessment which is labeled "concurrent" validity or, (2) validation based on test scores that were shelved and used at a later date in relationship to job performance which is labeled "predictive" validity. Even though there are many problems in predictive validity studies, psychologists believe this to be the superior validation procedure.

This study is basically longitudinal in that the psychological test scores were secured 15 to 20 years prior to the time of the study. But it is also a concurrent validity study in that biographical information and general contributions were secured at the time of the study.

Hypotheses:

The following two hypotheses will be investigated:

(1) There is a significant relationship between psychological test scores secured on subjects 15 to 20 years ago and creative performance on the job today.

(2) There is significant relationship between biographical information secured from subjects at the time of the study, and creative performance on the job today.

Statement of the problem:

A battery of psychological tests was administered to 143 graduating chemical engineers at the North Carolina State University during the years 1947-1951. A two part criterion for the prediction of creativity was constructed to be used in conjunction with these data. The Taylor-Ellison Biographical Inventory was also included as a predictor variable. An investigation of the relationships between the criteria and the predictor variables was the primary undertaking of this study.

Review of the Literature

This study involves (1) the development of criteria of creativity and (2) the determination of relationships of psychological test scores and the Taylor-Ellison Biographical Inventory with the criteria. The first half of this review of literature is concerned with the criteria of creativity; the second half with studies on the prediction of creativity.

Studies specifically devoted to the criterion problem are identified with fourteen investigators.[1] The research and literature suggest two approaches to the construction of a practical criterion of creativity. The criterion-seeker may choose to measure either the value, novelty, quantity of the contribution, or the behavior, skills, and characteristics of the person who made the contribution.

The more acceptable and popular approach has been to evaluate the tangible product of the creative act. (29,31,33,47,60,62,63). After the products are judged to be creative, this term "creative" can then be applied to the behavior that produced them, and then to the individuals who can be said to possess some degree of the trait creativity. (62) This therefore seems to be a step-by-step progression, culminating in the identification of the "creative individual."

Most validation studies are criticized because of their subjective evaluation of the product or the person. (38, 63) Some studies avoid the subjectivity involved in ratings by using a numerical count of publications, patents or novel ideas as criteria, but, unfortunately, the relationship of these criteria to the psychological correlates of creativity is tenuous.[2] Since gathering the ultimate criteria, the sum total of a man's lifetime creative acts, is not feasible, several studies suggest the use of a combination of approximate criteria. (29, 47, 73) Opinion supports the hypothesis that there is an advantage to using many approximate criteria together: any distortion introduced by an instrument incompetently applied or defective in itself will tend to be reduced.

In studying scientific creativity, researchers consistently return to certain types of "objective" criteria: patents, patent disclosures, publications, umpublished research reports, unprinted oral presentations, improved processes, new instruments, new analytical methods, ideas, new products, new compounds. A numerical count of these products has not proven as effective as ratings which also consider the novelty, quality and breadth of applicability of the product. (33, 47, 60, 71) Ideally, each creative contribution should be evaluated by authorities in that particular area. Publications should be considered in the light of joint-authorship, environmental controls, and evaluation of title, length, reference and content. Environmental influences complicate the use of such productive criteria since environmental controls alter the visible output of scientists and engineers. This is an important consideration when comparing the creativity of men who are employed by different companies and educational institutions. One example

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[1] C. W. Taylor, Creativity: Progress and Potential, (New York: McGraw-Hill, 1964), p. 157.

[2] John R. Hinrichs,"Creativity in industrial scientific research," AMA Bull., 12 (1961)

of the influence of the environment is the positive correlation between the number of papers published and the amount of freedom the individual is allowed in choosing his own research problem.[3]

On-the-job behavior, skills, and personality characteristics of the individual who made the creative contribution have also been measured and used as criteria of creativity. Flanagan suggests that creative individuals compile lists of "incidents" that are "critical" to creative performance so that men can be rated on creativity simply by using this behavior check-list. Other studies have employed psychometric devices to determine the characteristics that could differentiate the high-creative from the low-creative. (7, 17, 24, 27, 65, 71) Using construct validity, inferential data, long-term trends, and biographical analysis, numerous researchers have compiled what appear to be the component characteristics of the creative individual. (7, 17, 42, 51, 56, 71, 81)

Most of the available research supports the hypothesis that creativity is related to better-than- average intelligence in the total population. But, within a given group of practitioners operating at a fairly high level of intelligence, differences in general intelligence provide no significant prediction of differences in creative performances.[4] Getzels and Jackson found in their research that there was a difference in IQ between the very intelligent child and the very creative child, the former having an IQ of 150 and the latter having an IQ of 127, a 20 percent difference.[5] In 1962 these same men using a sample of 449 children found that the high IQ group and the high creativity group scored equally well on tests of attainment, but that teachers rated the high IQ children the more desirable students. The correlations between the IQ and the creativity scores were low. In this sample group the average IQ was high- 132. Following the same experimental set up, but at a later date, similar tests were given to 175 Scottish children, the average IQ being 102. In this sample, correlations between IQ and measures of creativity were much higher, inspite of the smaller range of ability. The high IQ group was also preferred by teachers but the high creativity group was lower in scholastic attainment. The results of these two studies seem to support the theory that after a minimum IQ of about 120 is obtained, intelligence is not highly related to creativity.[6]

A study by Guilford and Halpfner contributes to the historical information on the low correlations between the IQ test and other assessments of creative

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[3] Leo Meltzer, "Scientific productivity in organizational settings," J. Social Issues, 12 (1956), 39.

[4] Gary A. Steiner, The Creative Organization. Selected papers #2. Proceedings of Seminar, Graduate School of Business (Chicago, Ill.: University of Chicago Press, 1962).

[5] J. W. Getzels and P. W. Jackson, "The highly intelligent and highly creative adolescent: a summary of some research findings," The 1959 University of Utah Research Conference on the Identification of Creative Scientific Talent. Edited by C. W. Taylor (Salt Lake City, Utah: University of Utah Press, 1959), pp. 46-57.

[6] Parween Hasan and H. J. Butcher, "Creativity and Intelligence: a partial replication with Scottish Children of Getzel's and Jackson's study." British Jour. of Psychol., 57 (1966), 129-35.

aptitude and potential. A large number of tests of creativity (divergent-production ability) were found to possess a low correlation with the California Test of Mental Maturity IQ and a test of verbal comprehension. Creativity tests with more visual-figural information correlate systematically lower than those with either semantic (verbal) or symbolic (literal numerical) information. In this study there were almost no cases of high creative ability along with a low IQ; apparently there are few creative over-achievers but too many creative under-achievers.[7]

Highly creative individuals have been found to conform less than do non-creative individuals. (25, 38, 65) Creative people consistently score higher on traits of independence and autonomy on personality scales and appear to be more independent in judgment. (3, 26, 60, 63, 65) This would suggest that a culture which stresses conformity may eventually destroy itself since innovation may be eliminated. (42, 90)

High motivation appears to be characteristic of the creative individual. (7, 42, 56, 58, 60, 63, 81, 87) These people manifest a high interest in their work. The job evokes their spontaneous enthusiasm and deep concern: "To a certain extent work becomes his religion, the most important avenue for life fulfillment, his striving for completion."[8] The creative individual is more persistent in his work even if it is difficult and time-consuming. (65, 81) He seems to be driven more by interest and involvement in the task itself than by external incentives. Steiner suggests that there may be a limit to the amount of motivation that creative endeavors can tolerate. He states that the creative process is characterized by a sense of commitment, preoccupation, and perseverance. At the same time, high motivation narrows the focus and produces a rigidity which would tend to reduce creativity. It seems possible, then, that there may be a curvilinear relationship between creativity and motivation.[9] One may need enough motivation to maintain effort but not so much that it will produce attempts at immediate, rash solutions.

High activity levels are common among highly creative individuals. (17, 25, 42, 51, 60, 61, 63, 71, 76, 81) One study tested outstandingly creative chemists and mathematicians. A significant difference between the high-creative group and the low-creative group was that the high-creatives channeled enormous amounts of energy into productive research effort.[10] Some researchers have suggested that it is this high activity level that makes them appear to be obsessed with their work.

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[7] J. P. Guilford and Ralph Halpfner, "Creative Potential as Relates to Measures of IQ and Verbal Comprehension." Indian Jour. of Psychology. 41 (1966), 7-16.

[8] Eugene Raudsepp, Managing Creative Scientists and Engineers (New York: Macmillan Co., 1963), p. 33.

[9] Steiner, The Creative Organization, p. 19.

[10] B. S. Bloom, "Creativity research at the University of Chicago," The 1955 University of Utah Research Conference on the Identification of Creative Scientific Talent. Edited by C. W. Taylor (Salt Lake City, Utah: University of Utah Press, 1956), p. 188.

Creative people are able to produce an abundance of ideas and suggestions rapidly and, apparently, with minimal effort. (27, 71) But this does not imply that there is a linear relationship between quantity and quality of ideas. (27, 51, 71) The most valuable man is the one who can produce many ideas but who can also discriminate and select the best. (34, 56, 60, 75, 81)

The creative individual perhaps has a knack for perceiving and observing the unusual as demonstrated by his ability to slice phenomena into fresh perspectives and to devise uncommon solutions to problems. He can take apart firmly structured and established systems, dissolve pre-existing syntheses, and use elements and concepts beyond the limitations they possess in their primary contexts. (27, 56, 60, 61, 65)

Creative people are more flexible in their general work habits, capable of revising a pre-established approach to a problem when it gives evidence of being unsatisfactory. This may be due to the fact that they seem to have a less rigid personality structure. (87) The more inventive a person, the less inhibited and conventional are his actions. (17, 42, 63, 65)

The creative person can delay judgment until he has considered a situation adequately. He can recombine, reverse and rearrange his present information to produce a novel approach to a situation. (51, 81)

The highly creative person possesses an active curiosity which predisposes him to inquire into anything that evokes his interest. He enjoys discovery for itself and appears to be motivated toward delving into things. Interestingly, the curiosity of the creative individual usually extends far beyond the narrow confines of one sphere of interest and into many fields and topics. Things that are taken for granted by most people are full of mystery and interest for the creative individual. (25, 27, 42, 51, 56, 65, 71, 81)

Above-average working knowledge is usually characteristic of the creative individual. (17, 27, 42, 60, 61, 81) Creativity demands a backlog of information from which to draw and, consequently, most creative men make education and the acquisition of up-to-date knowledge a vital part of their daily work.[11]

After examining the literature available on the criteria of creativity, it appears evident that researchers in this area have not been able to determine a conclusive list of workable criteria. All of the criteria mentioned in the previous section appear to have a definite relationship to creativity, but the determination of the extent of these relationships has been left to future research.

Prediction of Creativity

The small number of studies relevant to the prediction of creativity has produced little conclusive evidence. The most recent research data reveal that biographical information is the most promising means of identifying

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[11] Raudsepp, Managing Creative Scientists and Engineers, p. 51.

creative talent.[12] It has been demonstrated to be a better predictor of creativity than high-level aptitude tests, intelligence measures, or personality test measures.

The biographical inventory used in this thesis was developed by C. W. Taylor and R. L. Ellison and is presently an important research tool for the Richardson Foundation. A summary article on the research use of biographical information to predict various criterion measures of successful performance and accomplishments in science was written in March 1967. It presented a summary of the information and data that has been accumulated from over 2000 scientists at NASA. Several interesting facts have consistently presented themselves; creatively scientific men have a high level of "professional self-confidence", are independent and intellectually oriented, have a high degree of dedication to their work, and set high levels of aspiration for themselves. It has been found that the same characteristics are involved in predicting creative and productive performance. This article cites Bloom in that "without a certain minimum amount of productivity there is a low probability of creative achievement." Although this inventory has been more successful in predicting supervisory evaluations of creativity rather than productivity, the major focus of these studies has been upon creativity criteria rather than productivity. In conclusion, this article states that further research needs to be done to discover the many possible uses and limitations of the biographical inventory.[13]

In 1961 the inventory was used at Lackland Air Force Base. It correlated highly with these criteria of creativity: supervisory ratings of creativity, supervisory ratings of over-all performance, creativity ratings by laboratory chiefs, and ratings on originality in written work. The following list contains descriptions of the psychological characteristics of the creative scientist. creative, inner-directedness, drive, cognition, quantity of reports, theoretical contribution, desire for principles, discrimination of value, aggressiveness, affability, professional self-confidence, low sociability, high self-sufficiency, dedication to work, self-reported academic level, and intellectual thoroughness. These results indicate the complexity of the prediction problem in terms of the number of variables functioning in creative performances. "Creative performance is dependent upon a large number of relatively separate variables, each one of which accounts generally for only a small unique and frequently almost statistically insignificant part of the total variation in creative performance. The validities of the best single scores for each criterion ranged in the .40's, .30's and .20's with a sizable number of scores being valid for most of the criteria."[14]

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12 C. W. Taylor and R. L. Ellison, "Predicting Creative Performance from Multiple Measures," in Widening Horizons in Creativity. Edited by C. W. Taylor (New York: John Wiley and Sons, 1964), pp. 227-240.

13 C. W. Taylor and Robert L. Ellison, "Biographical predictors of Scientific Performance". Science, 155 (March 3, 1967), 1075-1080.

14 C. W. Taylor and R. L. Ellison, "Predicting Creative performance from Multiple Measures," in Widening Horizons in Creativity. Edited by C. W. Taylor (New York: John Wiley and Sons, 1964), pp. 253.

The data from this study at Lackland Air Force Base were further analyzed at a later date. The main types of predictor measures used in the study and the number of scores for each type of test are listed in the following table. This table shows the percentage of scores valid for each predictor measure against the four most creative criteria. A predictor score was considered valid each time it correlated + .19 or greater (above the .05 level of significance).[15]

Table I

PERCENTAGE OF SCORES VALID FOR EACH PREDICTOR MEASURE AGAINST THE FOUR MOST CREATIVE CRITERIA

Number of Scores per Type of Test	(Predictive Measure) Type of Test	Percent of Four Most Creative Criteria
30	Biographical inventory	63%
17	Self-ratings	26%
1	Grade point average	25%
10	Cattell's Motivational Analysis Test	7%
26	Saunders' Personality Research Inventory	7%
16	Intellectual Aptitude Test	0%

W. D. Buel made a study using biographical data on 132 research personnel. Two criteria were used and both were in the form of personal evaluations on creativity. For purposes of differentiating varying degrees of research creativity, a 118 item biographical personal history form was administered to the sample. The results showed a correlation of +.65 between the criteria and patents, and +.68 between publications and the criteria. This study produced the following description of the creative man. The more creative tend to have a positive self-image, a need for personal independence in work, have wide interests, have a history of parental permissiveness in decision making, a tendency to become over-involved in his job, reacts positively to challenge, seeks unstructured work situations, and desires contemplative pursuits.[16]

Biographical inventories have often been avoided by researchers because they are of questionable validity when used on any population other than the original one. Buel, Albright and Glennon, however, made one study that demonstrated that the biographical inventory might have more generality than believed. They used a 33 item scoring key composed of "personal history items originally validated for research personnel in a petroleum lab. It was then applied to research personnel in a pharmaceutical lab. Significant validities were obtained, in the new setting, between personal history scores and several criteria of research productivity and creativity."[17] Another criticism is that

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15 Ibid., p. 244

16 Wm. D. Buel, "Biographical data and the Identification of Creative Research Personnel." Jour. of Applied Psychology. 49 (1965), 318

17 Wm. D. Buel, L. E. Albright, and J. R. Glennon, "A note on the Generality and Cross-Validity of Personal History for Identifying Creative Research Scientists." J. of Applied Psychology. 50 (June 1966) p. 217-220.

the biographical inventory is a "hodgepodge of motivational and personality traits" and approaches the prediction of creativity in a hit-or-miss fashion. (45)[18]

Another inherent complication in the biographical inventory was demonstrated by Ravenna Helson. She suggests that since there may be definite differences in the personalities of creative men and creative women, the biographical inventories and personality tests may predict far different things when the experimentors begin working more with women. The general results after 109 men and women mathematicians were judged creative and given the Mathematicians Q Sort which contains statements about research habits, attitudes, and the California Personality Test were:

1. Both creative men and women had less compulsiveness and emotional involvement in research than those less creative.
2. Creative men were more confident, forceful and effective than less creative men. Creative men tried to control the situation while creative women did not try to control it.
3. Creative men enjoyed active achievement-oriented symbolic manipulation. Creative women had a more inward-oriented passive directed concentration.
4. Creative men were more professionally participative, more self-acceptant, and achievement oriented than women who were equally creative.[19]

Psychological tests have long been a most popular predector variable. Buel and Bachner investigated the descriptive and predictive validity of several psychometric instruments for creativity. (11) Their instruments described the creative person as being intelligent, literary and extremely energetic. The authors used two different criteria of creativity with these instruments: a rather subjective measure of creativity, and a number of patents presently held by the man. Using the Kuder Preference Record and criteria of general scientific creativity, they had the following correlations: +.15 with computational interests, +.11 with persuasive interests, +.17 with scientific interests, and +.29 with literary interests.

By using the 47 items on the Strong Vocational Interest Blank that dealt with avoiding interpersonal contact, other researchers discovered that scientists and non-scientists could be differentiated. Their other psychometric measures indicated that chemists, engineers and mathematicians do avoid interpersonal contact and are highly self-sufficient. (40)

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[18] C. W. Taylor and R. L. Ellison, "Predicting Creative Performance from Multiple Measures," by Widening Horizons in creativity. Edited by C. W. Taylor (New York: John Wiley and Sons, 1964), pp. 253.

[19] Ravenna Helson, "Sex Differences in Creative Style". Jour. of Personality. 35 (June 1967) p. 233-34.

Detailed work using several psychometric instruments was done at the Hammond Organ Company. The following tests were given to 58 men: the California Psychological Inventory, the Vocational Preference Inventory, the Welsh Figure Preference Test, the Social Insight Test, Gough's Adjective Check List, the Concept Mastery Test and the Biographical Information for Research and Scientific Talent. The test scores were correlated with supervisor and peer ratings of creativity. The results suggest that self-reports and biographical data, especially concerned with reporting interests or achievements of a creative nature, are the most effective predictors. The predictors as a group were significantly related to the ratings of creativity but at a low level of confidence. The results suggest that ego strength is a critical correlate of creativity. Those engineers who rate themselves high on autonomy and aggression and dominance, and low on deference and abasement, were rated more creative. (43)

Performance on 53 test variables with the criterion of creativity produced 9 valid predictors for 88 industrial scientists and technologists at Naugatuck Chemical Division. The best test predictors with the rated creativity was +.67, corrected for bias. This study found that the creative scientist was capable of reasoning well with words and other symbols, fluent in the output of ideas, original in the quality of ideas, emotionally stable, determined to master his working environment, adventurous in outlook, high in degree of scientific curiosity, and low in indication of general anxiety. This was a rather high IQ sample: 28% had an IQ of 130 plus, 49% had an IQ between 115-129, 19% had IQ's between 100-114 and only 3 cases fell between 85-99. The criterion in this study was based on 12 ratings on different characteristics: analytical mindedness, communicativeness, idea mindedness, level of energy, liking for problems, organization in work, originality, perserverance, personal relations, practical mindedness, self-reliance, and technical competence. (41)

The Aluminium Company of Canada employed both the Kuder Preference Record and the Strong Vocational Interest Inventory to predict good research workers. Certain scales on the Strong discriminated significantly between the most and least successful workers. The most successful research men scored higher on the following scores: artist, psychologist, architect, physician, dentist, mathematician, physicist, engineer, chemist. On the following scales the least successful research men scored highest: sales manager, mortician, real estate salesman, life insurance salesman, and author-journalist. (39)

The National Merit Scholarship program found that, using a sample of 649 boys, certain aptitude and personality variables could be attributed to the creative individual. Using criteria of creativity based on product output, awards, etc., the following variables correlated significantly with their criteria of creativity: +.15 with artistic performance, +.36 with creative activities, +.10 with independent judgment, +.10 with mastery of facts, +.11 with ability to defer gratification, +.09 with breadth of interest, +.11 with initiative, +.09 with self-assurance, +.18 with physical activity, +.23 with intellectuality, -.17 with responsibility, -.07 with conformity, -.10 with verbal activity, -.18 with status drive (39)

Both Buel (11) and Sprecher (60) used a criterion of creativity developed from their subjects' descriptions of the creative act. Buel obtained 900 definitions of creativity from a group of scientists; the supervisors of these

scientists then rated them on creativity using their own definitions of creativity. These creativity criteria ratings correlated with certain personality and behavioral variables: +.62 with the ability to converse on the latest technical developments; +.58 with the habit of looking for a new way of doing things, +.55 with expressing desire to work on complex problems, +.41 with participation in professional societies in his field, +.41 with supervisory work in his area of specialization, +.38 with his ability to make new approaches to a problem, +.24 with enthusiasm for work, +.43 with energetic behavior, +.33 with willingness to work overtime, and +.32 with questioning orders of his supervisors. The creativity ratings correlated +.42 with patent disclosures, +.40 with patent applications, +.29 with patents issued, and +.13 with publication number.

Sprecher (60) proved that dissimilar occupational groups considered different aspects of behavior to be important in the creative process. Sprecher thought that this finding emphasized the importance of carefully defining "creative" when asked for subjective ratings on this trait. By describing all the behaviors characteristic of creativity, the rater simply had to check the behaviors that could be identified with the ratee. Using this system of rating, there would be less chance of making individually subjective determinations based on personal definitions of creativity.

Flanagan's use of "critical incidents" (21) is also directed toward eliminating the subjectivity of ratings by describing behaviors rather than working with semantic images.

Cattell's Sixteen Personality Factors questionnaire and Thurstone's Primary Mental Abilities Test were used at the University of Nebraska. The only significantly different factor between the creative and non-creative groups on the Thurstone was "verbal meaning." On the Cattell Personality Factors, the creative group scored higher on "self-sufficiency versus lack of resolution." (18)

An extensive study using Navy personnel yielded interesting results on the relationship between certain tests and behavior variables, and creative research work. (84) Taylor developed a check-list creativity rating scale on which 103 men were rated on creativity by their supervisors. Several months later Taylor developed a descriptive rating form scale using several variables considered to be important in research work. These were quality of work, quantity of work, initiative, originality, attitude toward work and skill in getting along with people. Each separate variable was first defined and then followed by a seven-step scale with each step on the scale being defined by a series of descriptive phrases. The same sample of 103 men was rated by this scale. These men had taken the following tests: the Strong Vocational Interest Blank which was scored for the engineering scale, the Terman Concept Mastery Test developed for use with gifted children, the Owen-Bennett Mechanical Comprehension Test, the Test for Productive Thinking by the Psychological Corporation, and the Test for Selecting Research Personnel developed by the American Institute for Research. When these tests were related to the descriptive and check-list rating forms, the following statistical correlations were obtained:

Table II

CORRELATIONS BETWEEN TESTS AND CHECK-LIST RATING FORM AND DESCRIPTIVE RATING FORM

	Strong Vocational Interest Blank	Terman Concept Mastery Test	Owen-Bennett Mechanical Comprehension Test	Productive Thinking	Selective Research Personnel
Check-List Rating Form	+.03	+.20	+.29*	+.24*	+.36*
Descriptive Rating Form					
Quality of work	+.16		+.20		+.24
Quantity of work					
Initiative	+.16		+.21	+.11	+.20
Originality			+.15	+.25	+.19
Attitude toward work				+.14	
Skill-with-people		+.22	+.10	+.19	+.26

*.05 significance

In order that tests might be employed to predict creativity in physical scientists, an extensive study was conducted to measure general and creative contributions. Only the first part of this study has been completed. Two hundred and fifty scientists listed numerous scientific contributions and measurements that could be made to detect creativity in their field. From these, 56 criterion items were selected as representative of productivity and creativity. The findings revealed that creativity ratings from supervisors, peers and monitors often correlated significantly: correlations between subjectively and objectively obtained data were negligible; correlations between supervisor and peer ratings for creativity and scores for research reports and publications were zero. Generally, each one of the 56 criteria correlated significantly with only 20 percent of the other criteria. The data were further analyzed by factor analysis to determine the relationships and clusterings of the contribution scores for 166 scientists. The main categories of 52 contribution scores proved to be largely unrelated. Statistically, they formed 15 relatively independent categories into which the contribution scores were classified; no more than 13 scores were sorted into any one category. Six of these categories were related to creativity. The first of these categories was "originality of work and thought." It was composed of the following items: rated originality of reports, rated significance of reports, number of suggestions made, and patent rate. (81) Examination of these categories and contributing scores is thought-provoking and demonstrates the complexity of the creativity criteria problem.

It is interesting to note that simple self-ratings on creativity have had a moderate validity for a variety of creative performances. The National Merit Scholarship study found evidence that self-ratings correlate as well as their other predictors with the various criteria of creativity. (39, 49) In this study self-ratings on creativity correlated +.15 with the criteria of creativity. Taylor and Ellison (79) also mention that the self-ratings are valid for every criterion possessing creative features in their study of Air Force scientists. These self-ratings were the best all-around predictors of creativity for all of the 17 criteria.

The studies cited have accepted validities between tests and their criteria of creativity as low as +.20. When it has been impossible to obtain validities even in this range, researchers have thought it best to gather together as many of the low validities as possible. Creative performances are extremely complex and no single test, no single theory of creativity will account for much of the total phenomena unless the single variable is, itself, very complex. Available information indicates that creativity is a complex multivariable phenomenon, demanding, perhaps, as many as twenty dimensions of human performance to account for creative behavior. This is undoubtedly why the biographical inventory has had the most success in predicting creative performance. (57, 79)

Conclusion

Generally speaking, the literature available on the prediction of creativity is neither extensive nor conclusive. All research indicates that creativity is a multivariate characteristic. No one criterion of creativity has been proven successful and not one predictor variable can consistently detect the creative person. Although researchers have been able to establish that the three most reliable predictor variables are biographical information, specific tests, and self-ratings on creativity, the small size of the correlations between these and the criteria of creativity have made results extremely tenuous. It is the purpose of this thesis to contribute additional information to this area by examining the relationship between test scores, personality traits, and biographical information.

METHODS AND PROCEDURES

General Design of the Study

A battery of psychological tests was administered to 143 graduating chemical engineers at the North Carolina State University during the years 1947-51. The purpose of this study was to assess the creative performance of these engineers some fifteen to twenty years after graduation and to relate the performance to test data secured at the time of graduation.

Independent and Dependent Variables

The supervisor rating form. The chemical engineers received this form directly and were asked to forward it to their immediate supervisor. A return-addressed, stamped envelope was included so that the form was sent directly back to the investigator. The form requested the supervisor to grade his colleague on the following traits: creativity, enthusiasm for work, persistance, independence, fluency of ideas, ability to perceive and observe, flexibility in work habits and procedures, initiative, knowledge of work, tendency toward conformity, and curiosity. These traits were selected after an extensive examination of the literature and consultation with men in scientific areas. They were the ones consistently chosen to be related to creativity. Each supervisor had to rank his individual colleague in a group of one hundred on the basis of his professional creative performance.

This form was constructed to minimize the semantical difficulties inherent in any type of rating form. The instruction page was followed by thirteen different-colored pages, each of which presented one of the traits. The characteristics were initially defined to provide the 76 supervisors with singular working definitions. A scale ranging from 1 through 11 followed each trait except the first: this was scored on a scale of 1 through 15 because it had been previously validated on the original Richardson form for Scientific Productivity. The even numbers on each scale were further defined in order to specify the degree of the trait that each number represented. The supervisor was to consider the trait as it was defined, find the scale number that best described the man in question, and then insert this number in the box provided at the upper left of the page.[20]

The scores obtained from these forms were individually related to the predictor variables. The over-all ranking on creativity was used both as a predictor and a criterion variable in this study.

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[20] The design of this rating form is based upon the same theory supported in Flanagan's "Critical Incident" technique. He found that a description of behavior, rather than the definition of a trait, made it possible for independent observers to make comparable reports. J. C. Flanagan, "Critical Incident Technique," Psy. Bull., 51 (1954), 327.

Biographical information sheet. This form was sent directly to each member in the study. Specific information was requested about his job, professional work, society memberships, awards, etc. Numerical estimates of the number of creative productions and descriptions of these were used. The man was required to rank himself on creativity as compared to 100 men in his field. The information obtained in this form was primarily intended to supply tangible evidence of a man's creative productivity. The number of patents per year, the number of ideas produced, etc., were used as part of the dependent variable. Some of the biographical information gathered in this form was not used in the study.

The scaling procedure on this form was difficult to construct. All of the questions demanding numerical estimates were multiplied by ten and tallied, giving each chemical engineer a single score for his tangible creative work. The self-rating score was used separately as a dependent and independent variable.

Biographical inventory of C. W. Taylor and R. L. Ellison. This form was used as part of the predictor variable. It was supplied and scored by the Richardson Foundation. Since biographical information had been proven to be a possible predictor of creativity in previous studies, this form was included in the hope of further substantiating this knowledge. This inventory was sent directly to the engineers with the other two forms.

The form itself contained 160 multiple-choice questions pertaining to all aspects of human experience. Four scores were derived from it. Score 1 was Professional Self-Confidence--the person's own assessment of his professional competence. Score 2 was Over-all Creativity--all items scored here were keyed against the creativity criteria. Score 3 was the Correction Score--above 50 indicated false modesty on the part of the individual completing the inventory, while below 50 indicated exaggeration. Score 4 was a Total Score figured from the other three.

This inventory was used as part of the predictor variables.

Tests Used[21]

Otis Self-Administering Test of Mental Ability. This test is purported by its author to measure mental ability, general thinking and intelligence. A twenty-minute time limit was used in the sample.[22]

Stanford Scientific Aptitude Test. This test was intended to be an index of scientific aptitude and is concerned with detecting a combination of basic traits which enter into what may be called an aptitude for science or engineering. The exercises contained in the test are descriptive of it.[23] They are: experimental bent, clarity of definition, suspended versus snap judgment,

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21 Oscar K. Buros (ed.), Mental Measurements Yearbook, 5th Ed. (Highland Park, N.J.: Rutgers University Press, 1935).

22 Arthur S. Otis, Otis Mental Ability Test (New York: Harcourt, Brace and World, Inc., 1954).

23 D. L. Zyve, Stanford Scientific Aptitude Test (Palo Alto, Calif.: Consulting Psy. Press, 1937).

reasoning, inconsistencies, fallacies, induction-deduction, generalization, caution, thoroughness, discrimination and arrangement of experimental data, accuracy of observation and interpretation. This test was administered with no time limit but normally requires about an hour and a half to administer.

Bernreuter Personality Inventory. The Bernreuter Personality Inventory deals primarily with personality evaluation. It tends to identify general personality inadequacies better than it evaluates individual suitability for particular jobs or life situations. Three scales were used in this study.[24]

B1-N. This score is a measure of neurotic tendencies. Persons scoring high on this scale tend to be emotionally unstable. Extremely high scores indicate a need for psychiatric examination, while those scoring low tend to be emotionally well balanced.

B2-S. This is a scale of self-sufficiency. Persons scoring high on this scale prefer to be alone, rarely asking sympathy or encouragement, and tend to ignore the advice of others. Those scoring low on this scale dislike solitude and often seek advice and encouragement.

B4-D. This is a measure of dominance-submission. Persons scoring high on this scale tend to dominate others in face-to-face situations. Those scoring low tend to be submissive.

The Strong Vocational Interest Blank. The interest blank compares the similarity or dissimilarity of an individual's interest pattern with those people who are successfully employed in the occupation. The blank itself contains 400 test items listing occupations, school subjects, hobbies, etc. to which persons respond by expressing like, dislike, or indifference. The men's scores are available for more than 50 occupations and these are divided into groups. The sample of engineers was scored on the following groups: (1) Biological sciences, (2) Engineering and physical sciences, (5) Social service and welfare occupations, (8) Business detail and administration, (9) Sales or business contact, (10) Verbal or linguistic occupations, Engineer scale, Chemist scale, Production Manager scale, Personnel Manager scale, and Occupational level. The reliability of the test using the odd-versus-even technique gives a coefficient of .877. Extremely high validities are presented.[25]

Bennett Test of Mechanical Comprehension. This test was designed to measure the ability to understand the relationship of physical forces and mechanical elements in practical situations. It contains 60 items which include a picture exhibiting one or more objects, or physical or mechanical relationships about which a question permitting a categorical answer is asked. This is an untimed test which takes about 25 minutes and has been used successfully for years in vocational and educational guidance.

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[24] Robert Bernreuter, Bernreuter Personality Inventory (Stanford, Calif.: Stanford University Press, 1935).

[25] Ed. K. Strong, Jr., Strong Vocational Interest Blank (Palo Alto, Calif.: Consulting Psy. Press, 1959).

It is interesting to note that the Bennett Test of Mechanical Comprehension correlates rather highly with some other tests. Correlations of +.45 were obtained using the Otis Intelligence Test and the Bennett Test in an introductory engineering course. Correlations between +.51 and +.44 were obtained when the Revised Minnesota Paper Form Board was related to the Bennett Test.[26]

Description of Sample

During tne years from 1947 to 1951, 143 chemical engineers took the battery of tests. Replies to the first communication numbered 136. In the final analysis, 76 men completed all of the forms.

It became obvious as forms were returned that a great number of the engineers were no longer in chemical engineering. Some of these men were in sales, administration, teaching, and management. Table III presents these data. The use of a scientifically oriented criterion of creativity would place those men who had branched into occupations unconnected with scientific research at a disadvantage. Tangible creative evidence was not measurable, due to occupational limitations. A less scientifically oriented criterion might have allowed for more accurate creativity ratings.

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[26] George K. Bennett, Bennett Test of Mechanical Comprehension. (New York: Psy. Corp., 1956).

Results

Tables:

The results of the study are shown in tables and charts in the Appendix. Reference, in the discussion of results, will be made to these tables. Also included in the Appendix are the Supervisory Rating Form and the Biographical Information and Contribution Form, completed by the participants in the study.

It will be impossible to review and analyze every aspect of the tables because of space. Moreover, this will not be necessary since the reader will be able to analyze much of the content on his own.

Means and Standard Deviations:

The means and standard deviations of the predictor and criterion varibles are presented in Tables I and II. These tables need no discussion. The means and standard deviations of the predictor variables are in line with the means and standard deviations secured by other investigators who have completed research with the same group of chemical engineers.[27] Frequency distributions were completed for every predictor and criterion variable. These are shown in the Appendix in Charts #1 through #8, and Charts #9 through #24. Inspection of these charts indicates that the distributions are, in general, quite normal and that the analyses are being conducted with fairly normal distributions.

Intercorrelations:

The intercorrelations for the 18 predictor variables are shown in Table IV of the Appendix, and the intercorrelations of the criterion variables are shown in Table V. The significance of these intercorrelations at the .05 and .01 level is indicated. An analysis of the intercorrelations of the predictor variables discloses relationships that are to be expected and are in line with the intercorrelations given in the manuals for those specific tests. The B1-N (neuroticism) scale of the Bernreuter Personality Inventory was not reflected and an inspection of Table IV shows that the scale is negatively correlated with B2-S (self-sufficiency) and B4-D (dominance). The Otis Intelligence Test is correlated with the Stanford Scientific Aptitude Test to the extent of .310. This correlation was significant at the .01 level. The Stanford Scientific Aptitude Test is correlated with the Bennett Mechanical Comprehension Test, form BB, also at the .01 level with a correlation index of .462. An analysis of the intercorrelations of the Strong Vocational Interest Blank will show that these are in line with those indicated in the Strong manuals. The correlations of all the predictor variables against the grade point average at the end of the senior year are shown in Table IV. Interestingly enough, only one correlation achieved significance at the .05 level. This was .266 between the Stanfo.d Stanford Scientific Aptitude Test and Grade Point ratio.

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[27] Reference is being made to three theses that were previously done on this same sample of chemical engineers at the North Carolina State University. The theses are included in the bibliography. The authors of the three theses were: Charles R. Milton, Lela H. Coltrane, and Arnold C. Aspden.

The intercorrelations of the criterion variables are shown in Table V. Practically all of these intercorrelations were significant at the .01 level which signifies that there are high interrelationships among the 12 criterion variables. Only two correlations did not achieve significance. These were the correlation between Perserverence and Knowledge, and between Creativity and Conformity.

Correlations Between Predictor and Criterion Variables

The correlations of the predictor variables with the criterion variables are shown in Table VI. These correlations, in general, show the following relationships: Intelligence, as measured by the Otis Intelligence Test administered approximately 15 years ago, is not significantly related to creative managerial performance today. These correlations were all or near zero and did not reach the .05 or .01 level of significance. An evaluation of the coefficients indicates that there might be a slightly negative relationship since most of the coefficients were negative in significance but near a zero value.

Mechanical and Scientific Aptitude, as measured by the Bennett Mechanical Comprehension Test and the Stanford Scientific Aptitude Test, did have some statistically significant relationships with creative performance today. These were principally with the Stanford Scientific Aptitude Test and five of them did reach the .05 significance level. These relationships were with Enthusiasm, Fluency, Activity, Flexibility and Initiative. They were all negative correlations. The Bennett Mechanical Comprehension Test correlated significantly with Activity on the Rating Form. This correlation was also negative and significant at the .05 level. Four significant relationships with the B2-S of the Bernreuter were disclosed. These were positive and the relationships were with Persistence, Enthusiasm, Independence and Initiative. The correlation between B1-N and the criterion variables were all near zero and were not significant. However, they were all negative, showing an inverse relationship, which is to be expected. This B4-D scale of the Bernreuter correlated positively and at a .05 level with Enthusiasm and Self-Rating. It can be concluded from these results, that the personality pattern of the creative manager today is typified by the college senior who was emotionally stable, self-sufficient, and dominant.

Five significant correlations were obtained between the Occupational level scale of the Strong Vocational Interest Blank and the dimensions of the Rating Form. The dimensions of the rating form were Creativity, Enthusiasm, Fluency, Activity and Flexibility. The highest correlation was with Enthusiasm .436. Two significant relationships were obtained between Sales scale and the Rating Form and two with the Linguistic scale of the Strong Vocational Interest Blank. From the standpoint of the interest test it can be stated that the college senior who had interests similar to people in business, sales and linguistics scored higher on creative performance today. A high need to achieve in college, characterized by a desire for a higher level occupation, demonstrated the strongest relationship with creativity. The correlations were not as high, but were still in line with the correlations generally achieved in predictive validity studies.

Multiple Correlations:

A number of regression analyses were conducted. These involved the use of all 18 predictor variables taken as a complete set and related to the dimensions of creative managerial performance. These are shown in Table VII. In general, these did not prove to be statistically significant. Only one multiple correlation was significant; this was between Enthusiasm, and all the predictor variables. The multiple correlation was .607 making it significant at the .05 level.

A difficulty of this method is that one consumes many degrees of freedom, especially when the number of observations is low. Accordingly, a step-wise method of analysis was used and an example of the results of this method is shown in Table VIII. The predictor variables that isolate themselves as a group against the average of the 12 criterion variables at the .01 level of significance are: (1) the Stanford Scientific Aptitude Test, (2) the Bernreuter Self-Sufficiency scale, (3) Strong (group 11), (4) Strong Engineer, (5) Occupational Level. At the .05 level the combination of variables is: (1) the Stanford Scientific Aptitude Test, (2) B1-N, (3) B2-S, (4) B4-D, (5) Strong II-Engineering, (6) Strong IX-sales, (7) Strong-Engineering (8) Occupational Level (9) Grade-point average.

The same technique was used to determine relationships between criterion variables and the biographical inventory. These are shown in Table IX. The step-wise method was also used to isolate predictor variables against the Creativity dimension of the Supervisory Rating Form and against the Contribution index. These are shown in Tables X and XI. The step-wise method was used to isolate biographical scores against the Creativity and Contribution dimensions. Results of these relationships are shown in Tables XII and XIII.

Analysis of Biographical Data:

The Taylor-Ellison Biographical Inventory was not administered at the time the psychological tests were given to the participants as Seniors. Even though it was not given then, the inventory has items in it that sample antecedent behavior from childhood, high school, college, and adult years. The inventory is scored for Professional Self-Confidence, Over-all Creativity, a correction score and an Over-All weighted score in creativity. The correlations of these dimensions with the Creative Scale of the Supervisor Rating Form and the Contribution Index are shown in Table XIV of the Appendix. Except for the correction score, the other scores are significantly related to Creativity at the .05 level. The Over-all Creativity Index and the Over-all weighted score were correlated significantly at the .05 level with the Contributions. The score on the Professional Self-Confidence scale did not achieve significance. In both cases the correction score did not achieve significance. In both cases the correction score did not reach any level of relationship with other criterion. Table XV shows the intercorrelations of the sub-part and total scores. These results demonstrate the fact that the biographical inventory is definitely related to creative managerial performance.

Self-Rating:

This is a relatively unexplored area in the whole field of criterion research. There are only a few studies to indicate that this may be an

approach to the development of performance indexes. Each participant in this study was asked to evaluate his own creative ability. This then was related to supervisory ratings and to the biographical inventory. In general, these results indicate that a self-rating of one's own creative ability is related to the evaluation of creativity made by a supervisor. A correlation of 0.595 was achieved between the total score on the biographical and self-rating. This and other correlations between the total biographical and the individual criterion dimensions are shown in Table XVI. The correlations between the total biographical and overall creativity and contributions were not as high.

Factor Structure:

A factor analysis was conducted with both sets of data; the predictor and criterion variables. The rotated factors loadings for the predictor variables are shown in Table XVII and the rotated factor loadings for the criterion variables are shown in Table XVIII. The principle component method for extraction of factors with a verimax system for rotation was used. Seven factors were isolated for the predictors variables and four for the criterion variables. The seven factors for the predictor variables were designated as follows: (1) Professions, Engineering, Business, (2) Personality, (3) Personnel, (4) Linguistic Occupational, (5) Academic, (6) Intelligence, (7) Production Manager. An examination of the factor loadings indicates that Intelligence and the Production Manager scale of the Strong Vocational Interest Blank were isolated as unique factors. The Bernreuter Personality Inventory also separated as a single factor. The loadings are bipolar and this is to be expected since the B1-N scale of the inventory was not reflected. The group Personnel key of the Strong Vocational Interest Blank isolated with the Personnel Manager key. The Stanford Scientific Aptitude Test and the Bennett Mechanical Comprehension Test both separated out with the Grade Point Ratio. The four factors for the criterion variables were designated as follows: (1) Activity, (2) Creativity, (3) Independence, and (4) Knowledge. Two dimensions separate as unique factors: Independence and Knowledge. This presents an interesting disclosure since most previous studies have indicated that independence does seem to be characteristic of the creative individual. It appears reasonable to accept the fact that knowledge is a singular factor since the creative individual is using other cognitive and personality traits in his creative performance. This analysis is comparable to the notion that intelligence is not related to creativity once a given level of intelligence has been reached. The creativity dimension of performance clustered in a negative domain with Enthusiasm, Fluency, Perception, Flexibility, Initiative, Conformity and Curiosity. This makes sense when related to other studies in the field of creativity. Incidentally, this type of analysis is generally recommended in factor analytic studies where it is possible to put into the system a factor that has already been proven to be so in previous research. A more loosely integrated factor was also isolated and identified as Activity. Four of the six loadings in this factor were also significant in the creativity factor, but in a positive domain. Activity and Persistence, two factors that would normally be anticipated to be characteristic of creativity, isolated themselves in the Activity factor rather than in the Creativity factor. The results of the factor analytic study were not used in the statistical analyses of the report.

Canonical Correlation:

A canonical correlation is a relatively unused statistical technique. This statistical correlation was discovered by Dr. Harold Hotelling in 1936. It provides an index of relationship between two sets of data and shows the maximum correlation possible between the two sets. Regression weights for variables in both sets are generated. The canonical correlation when obtained is interpreted in the same way as an ordinary coefficient of correlation. The results of this analysis are shown in Table XIX. The correlation achieved by this method was .823 and is significant at the .05 level. It is possible by this method to double or even triple the amount of variance accounted for in comparison to the usual regression techniques.

Comparison of the Chemical Engineers who Completed all the Forms with Those who Did Not.

A comparison was conducted between the group that completed all the forms with the group that did not complete them. There were 76 men in the first group and 52 in the second. A "t" test was used to determine the significance of the difference between the means. These are shown in Table XX. All of the "t" values did not reach significance at the .05 level. This means that the group that did not respond is basically no different on the psychological tests, administered at the time of graduation, from the group that did complete all the forms. The question is often raised in follow-up studies that there might have been a sampling bias- the group that did respond was different from the group that did not respond. This was not the case in this study. It appears that continued effort should be made to secure responses from the group that did not complete the information.

SUMMARY AND CONCLUSION

This is a longitudinal study with the objective of predicting creative managerial performance of a group of managers approximately fifteen years after graduation from the North Carolina State University. It is the first part of a creativity research project that is being conducted at the University of North Carolina in the Graduate School of Business.

In the fall of 1965, the Richardson Foundation, an organization in Greensboro, North Carolina concerned with supporting and encouraging research in the area of creativity, approved support of a study on predicting creativity. Dr. D. J. Moffie had obtained usable data fifteen years previously on a group of 143 chemical engineers from the North Carolina State University. These data were in the form of psychological test scores from the following instruments: the Otis Intelligence Test, the Stanford Scientific Aptitude Test, the Bennett Mechanical Comprehension Test, the Bernreuter Personality Inventory, and the Strong Vocational Interest Blank.

In order to set up a predictive validity study to examine the ability of these psychological tests to predict the creative individual, it was necessary to get a measure of each chemical engineer's creativity. Two instruments were developed for the purpose of discovering how creative each man had been since graduating from college. The first was a creative performance evaluation secured by a 12 dimension rating form to be completed by each man's immediate supervisor. The first dimension in this rating form was a general "creativity" rating. The second was a form to be completed by each chemical engineer himself, estimating the number of patents, publications, and significant "contributions", etc. he had made since graduation.

The Taylor-Ellison Biographical Inventory was also used as a predictor variable in the hope that it might predict the creative individual as well, if not better, than the test scores.

Each of the original 143 men was contacted and his co-operation requested. The three forms were sent to each individual: the Supervisor Rating Form, the Taylor-Ellison Biographical Inventory, and the Biographical Information sheet. From the original sample of 143 men, 76 men completed and returned the three forms. The data were then analyzed.

Intelligence, as measured by the Otis Intelligence Test fifteen years previously, is not significantly related to creative managerial performance today. Other studies confirm this relationship in that once a certain level of intelligence has been achieved, intelligence is not related to creativity. Mechanical and scientific aptitude although important for college success, show a few significant negative relationships to creative performance. The personality pattern of the creative manager today is typified by the college senior who was emotionally stable, self-sufficient and dominant. The college senior who had interests similar to people in business, sales and linguistics scored higher on creative performance today. A high need to achieve in college, characterized by a desire for a higher level occupation, demonstrated the strongest relationship with creativity.

The relationships between the Taylor-Ellison Biographical Inventory and the criterion measures demonstrate that biographical information is definitely related to creative managerial performance. This, again, supports previous findings that one may assess creative performance through antecedent behavior.

A Self-Rating on one's own creativity is a strong indicator of the evaluation of creativity made by a supervisor. There were significant positive correlations supporting these facts.

One of the difficulties inherent in this study was the diversity of occupations in which the members of the sample were engaged. Obviously the research-oriented definition of creativity put men in sales and administration at a disadvantage in giving a true rating of their creative ability.

The rest of the data indicates that the creative manager is an intelligent individual who is emotionally stable, self-sufficient and dominant. He is characterized by a desire for a higher level occupation, as well as interests in business, sales and linguistics.

The predictor instruments indicate that antecedent behavior and self-appraisal of one's own creativity are fairly good predictors of creative managerial performance.

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APPENDIX

TABLE I

Table of Means and Standard Deviations of

Predictor (Independent) Variables

VARIABLES	MEANS	STANDARD DEVIATIONS
1. Otis Self-Administering (Intelligence)	55.57	7.49
2. Stanford Scientific Aptitude	59.04	11.70
3. Bennett Mechanical Comprehension	49.71	7.63
Bernreuter Personality Inventory		
4. BI-N (Neuroticism)	29.16	25.04
5. B2-S (Self-Suffiency)	49.09	24.86
6. B4-D (Dominance)	65.49	23.82
Strong Vocational Interest		
7. Group I Biological Sciences (Professional)	35.36	8.75
8. Group II Physical Sciences (Engineering)	44.57	11.26
9. Group V (Social Service or Welfare)	35.57	9.11
10. Group VIII (Business Detail-Administrative Occupations in Business	35.54	8.41
11. Group IX Sales or Business Contact	34.29	9.09
12. Group X Verbal or Linguistic	30.93	5.85
13. Engineer Scale	40.74	11.09
14. Chemist Scale	40.62	12.44
15. Production Manager	45.63	7.94
16. Personnel Manager	34.24	10.66
17. Grade Point Ratio	17.76	4.60
18. Occupational Level	52.57	4.93

TABLE II

Means and Standard Deviations of Criterion (Dependent) Variables

VARIABLE	MEAN	STANDARD DEVIATION
I. Rating Form:		
1. Creativity	9.16	2.34
2. Persistence	8.22	1.69
3. Enthusiasm	7.86	1.89
4. Independence	7.61	1.57
5. Fluency	7.37	1.55
6. Perceptiveness	7.01	1.68
7. Activity	7.76	1.68
8. Flexibility	7.38	1.80
9. Initiative	7.87	1.86
10. Knowledge	8.11	1.35
11. Conformity	7.09	1.72
12. Curiosity	7.25	1.66
II. Overall Rating by Supervisor	66.32	17.04
III. Self Rating by Engineer	61.97	17.59

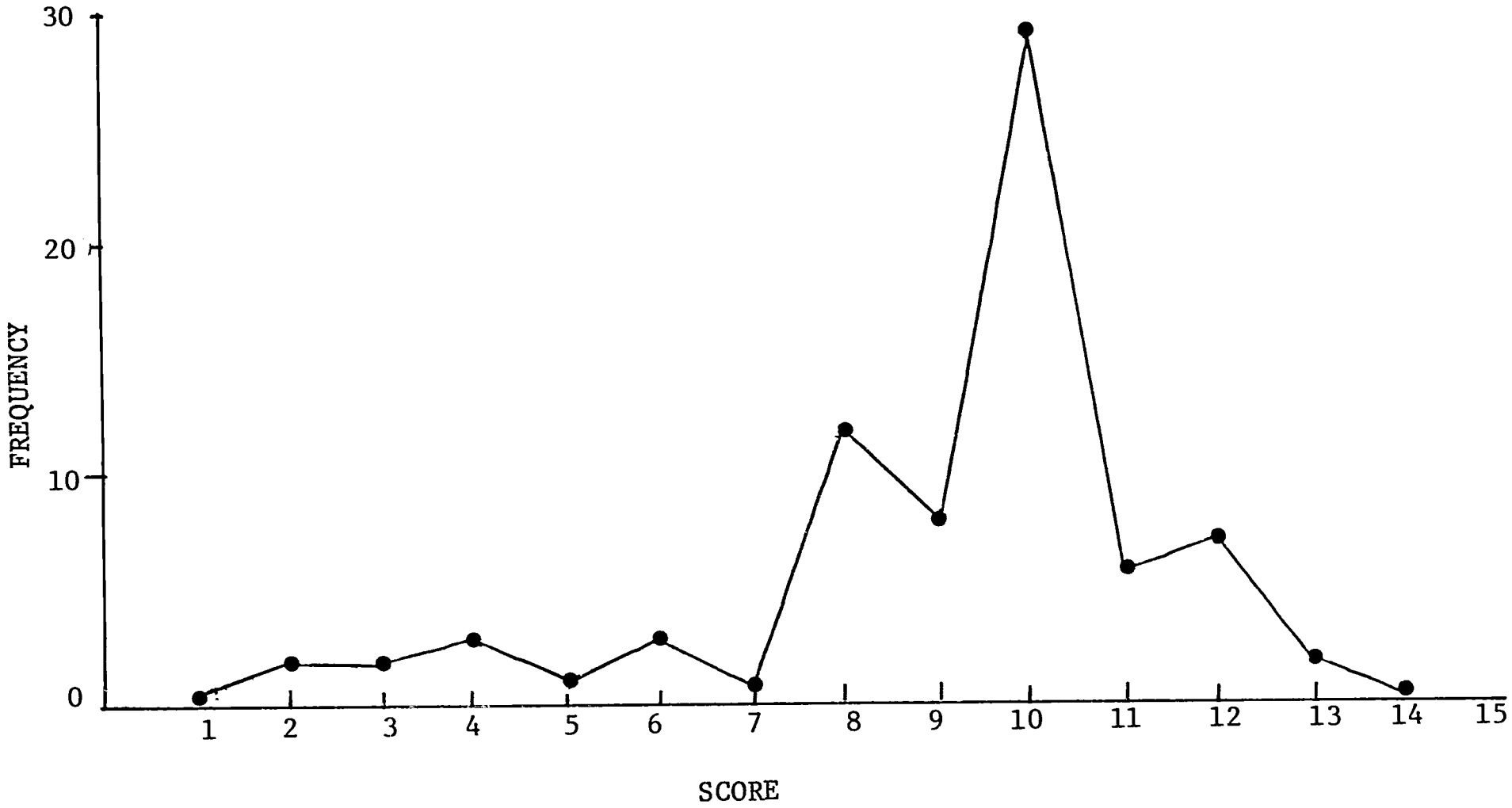

Chart 1. Distribution of Scores on Creativity Dimensions of Rating Scale

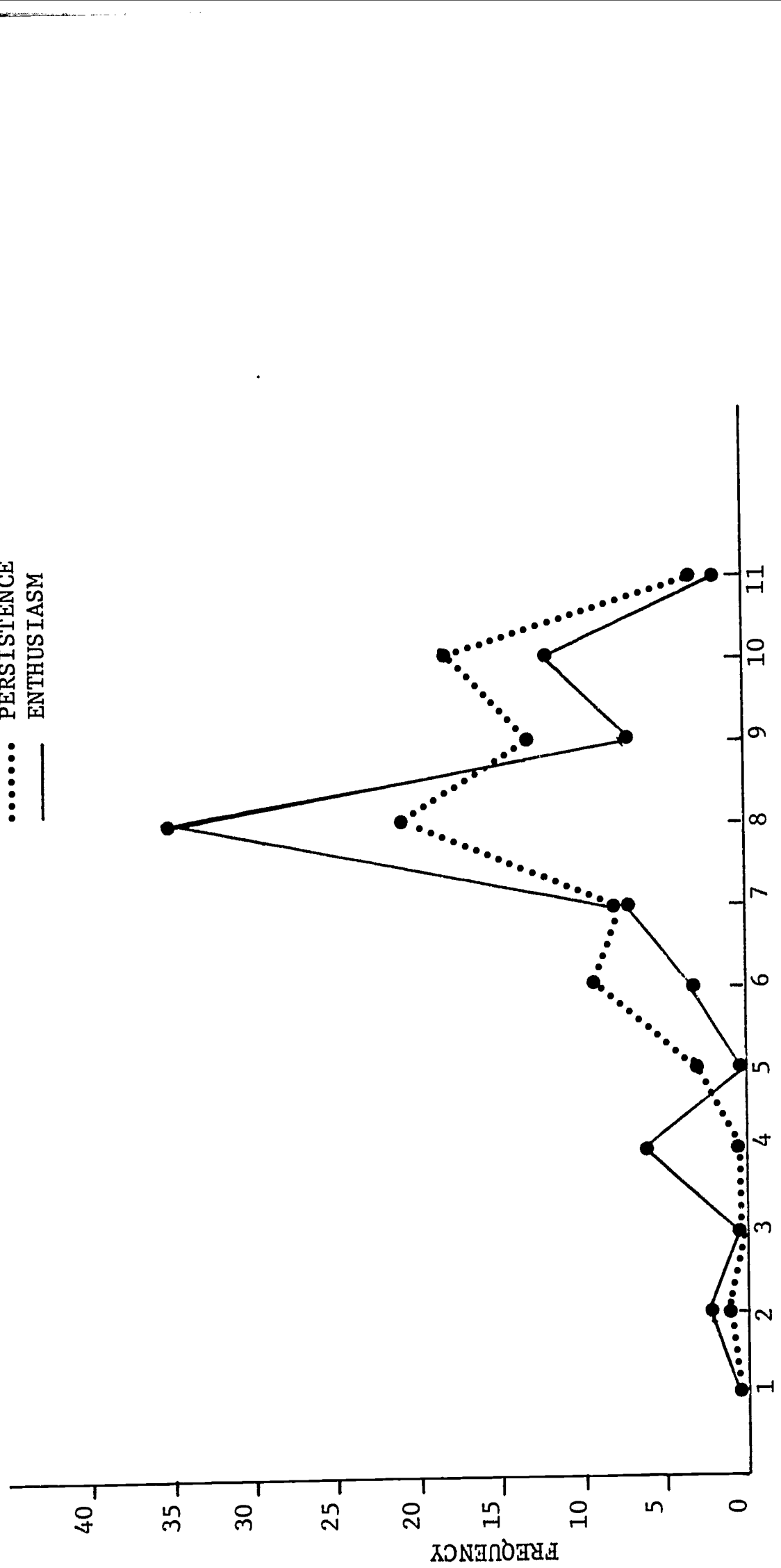

Chart 2. Distribution of Scores on Persistence and Enthusiasm Dimensions of the Rating Scale

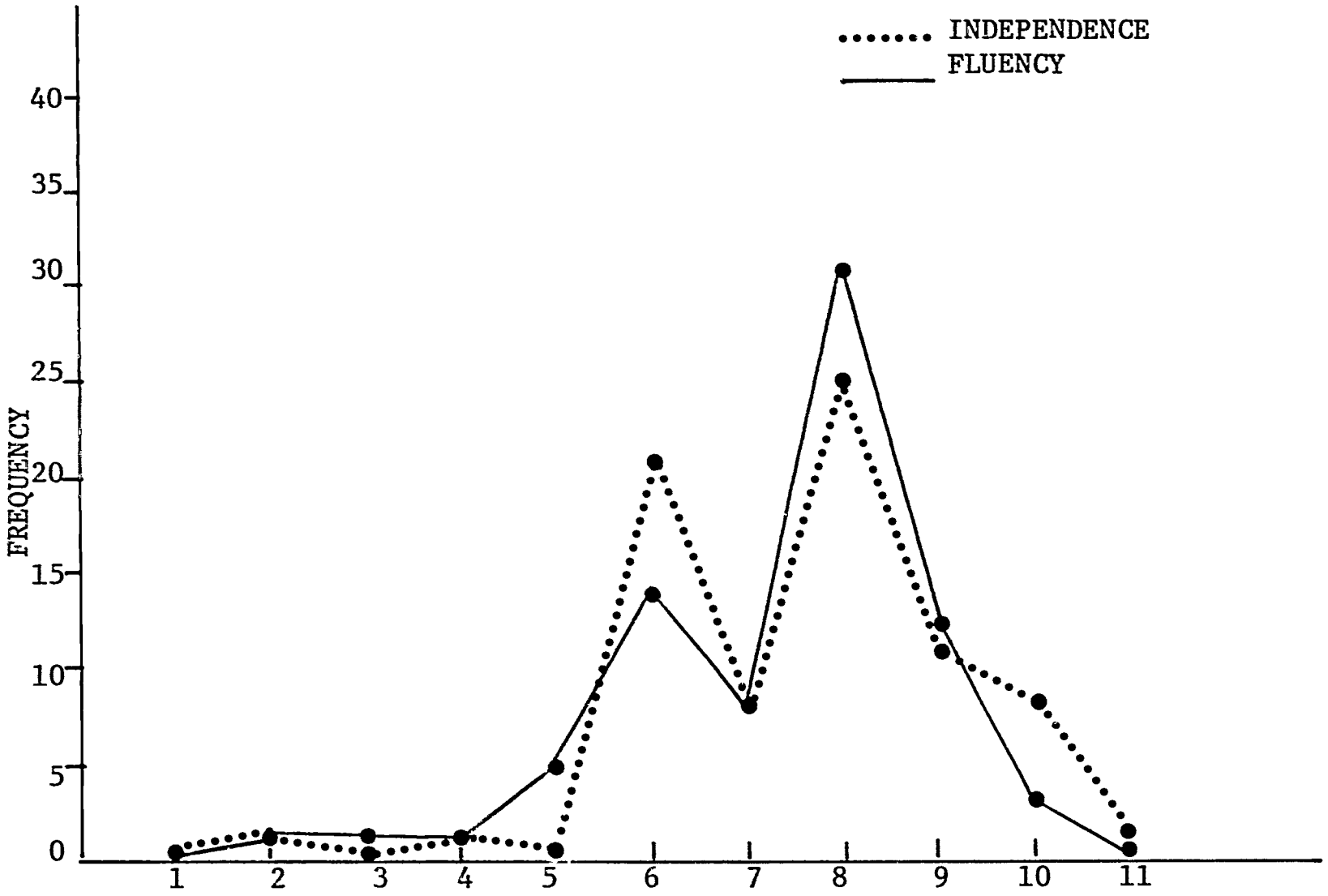

Chart 3. Distribution of Scores
on Independence and Fluency Dimensions
of the Rating Scale

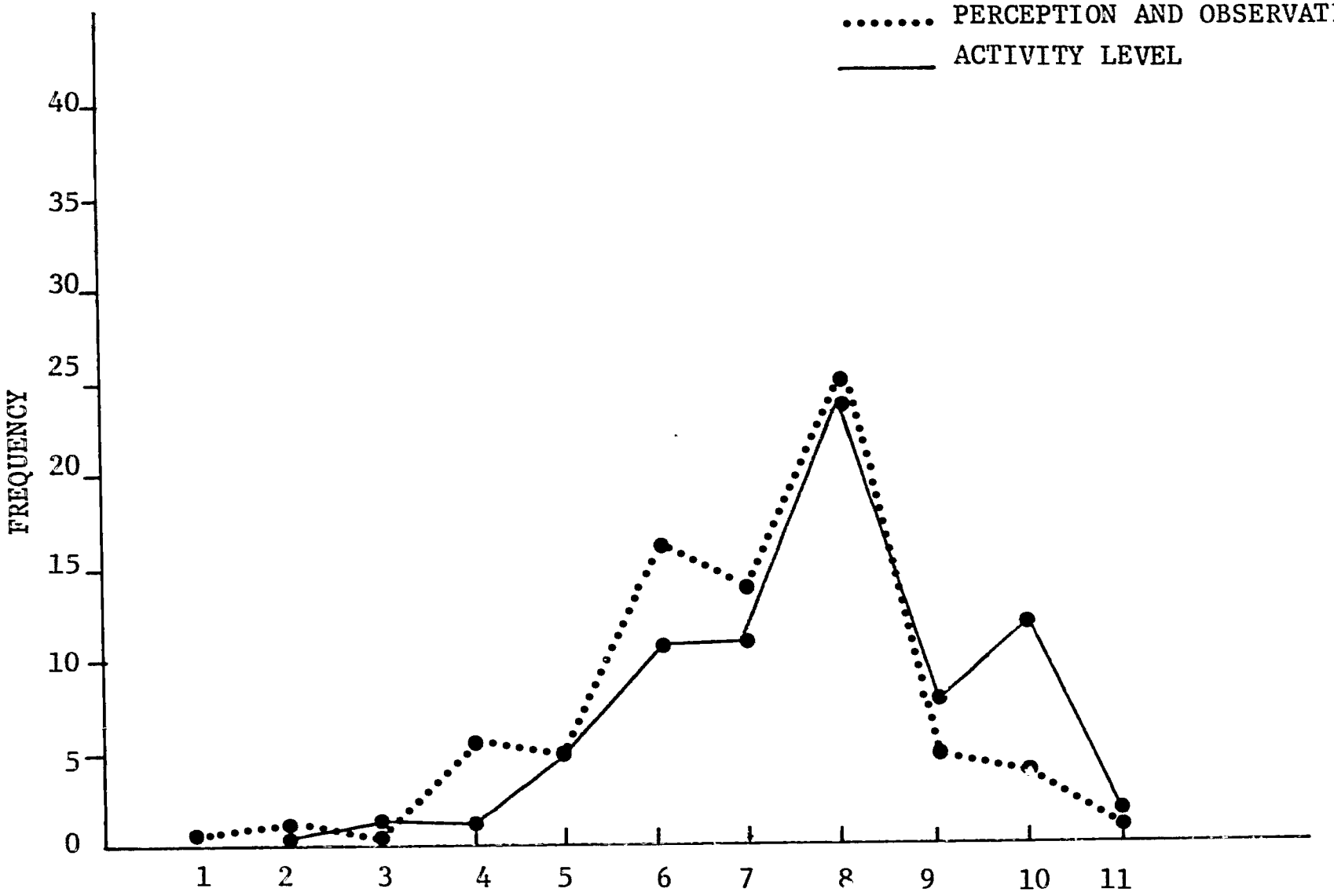

Chart 4. Distribution of Scores
on Perception and Activity Level Dimensions
of the Rating Scale

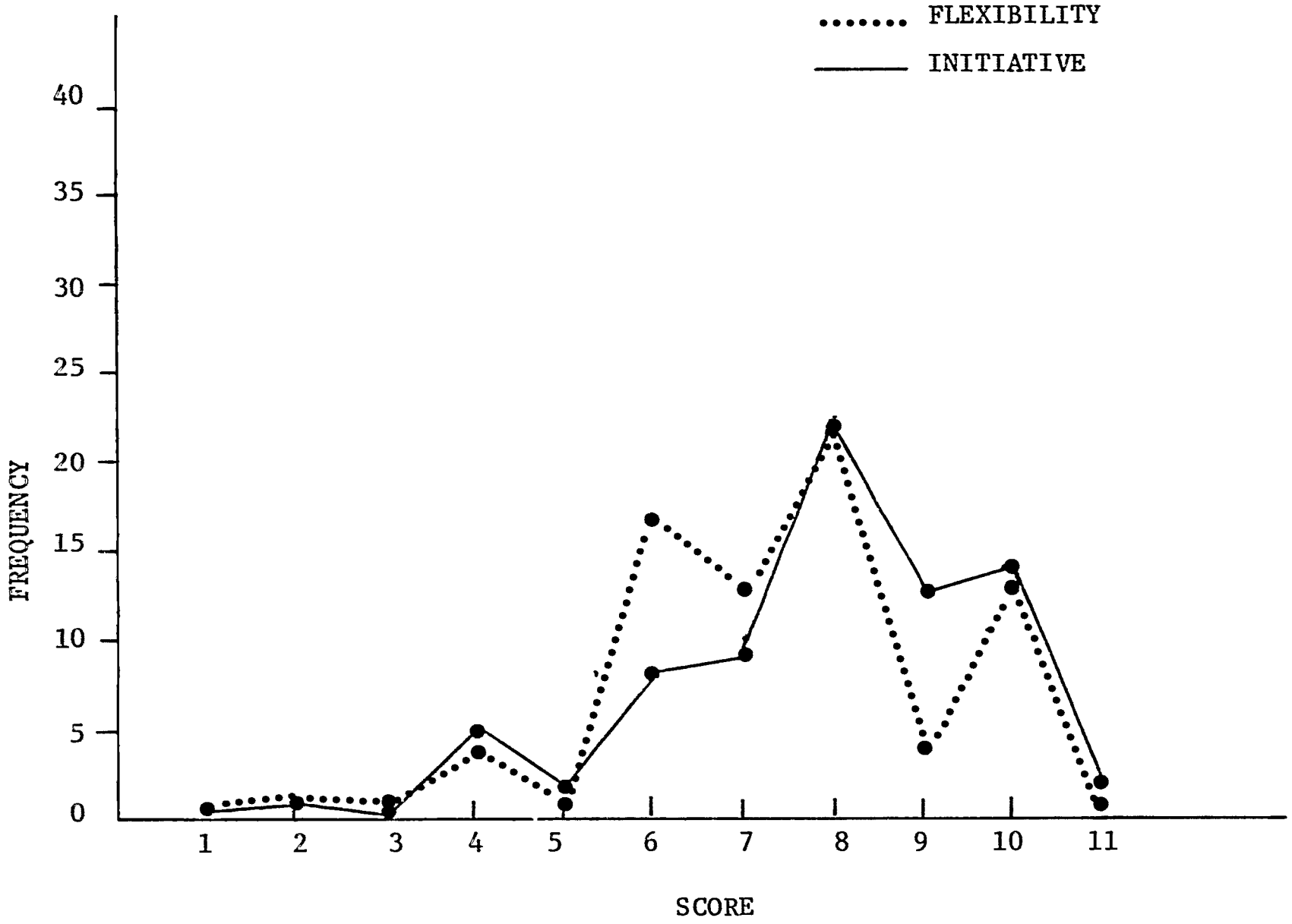

Chart 5. Distribution of Scores
on Flexibility and Initiative Dimensions
of the Rating Scale

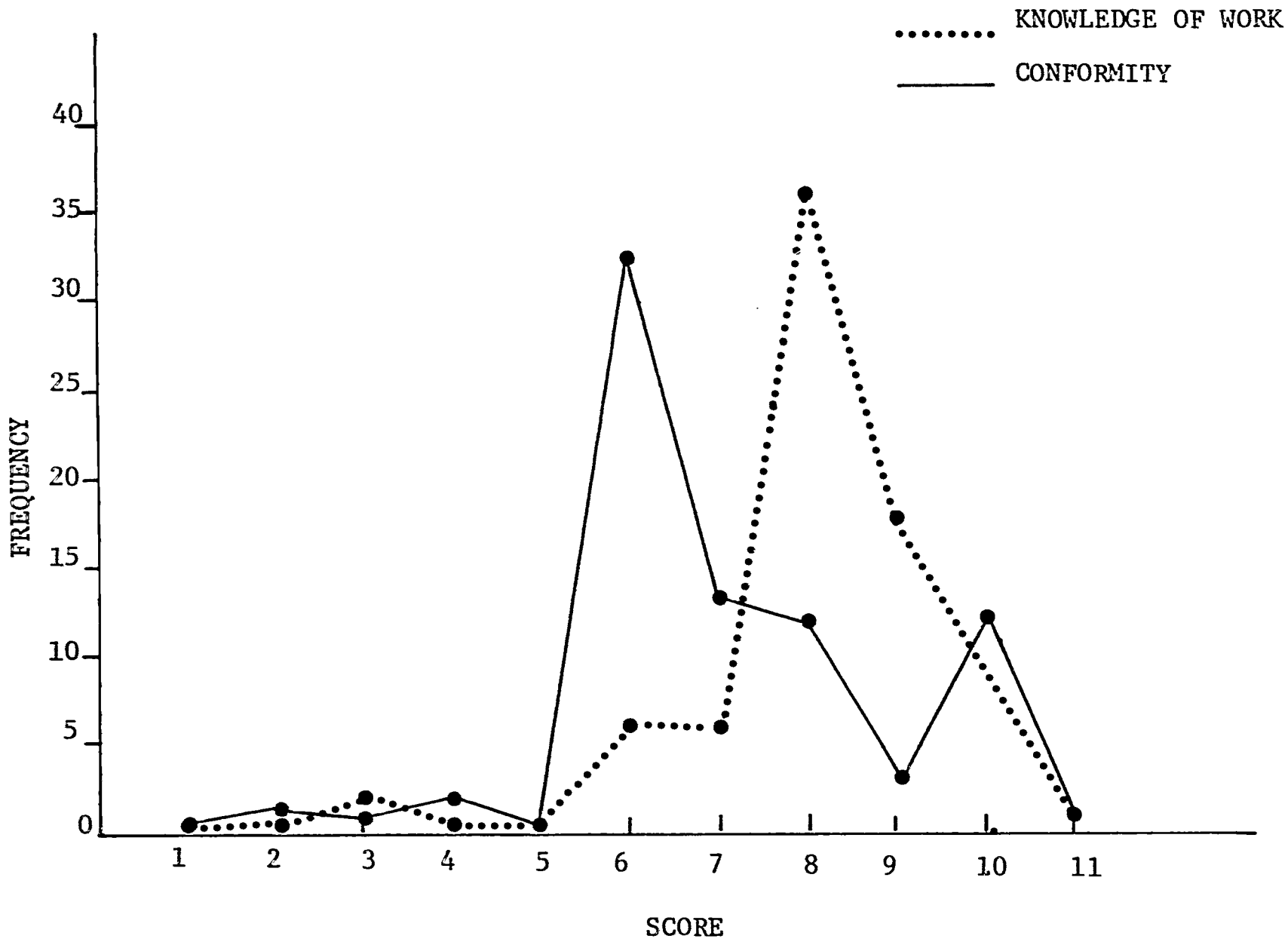

Chart 6. Distribution of Scores
on Knowledge and Conformity Dimensions
of the Rating Scale

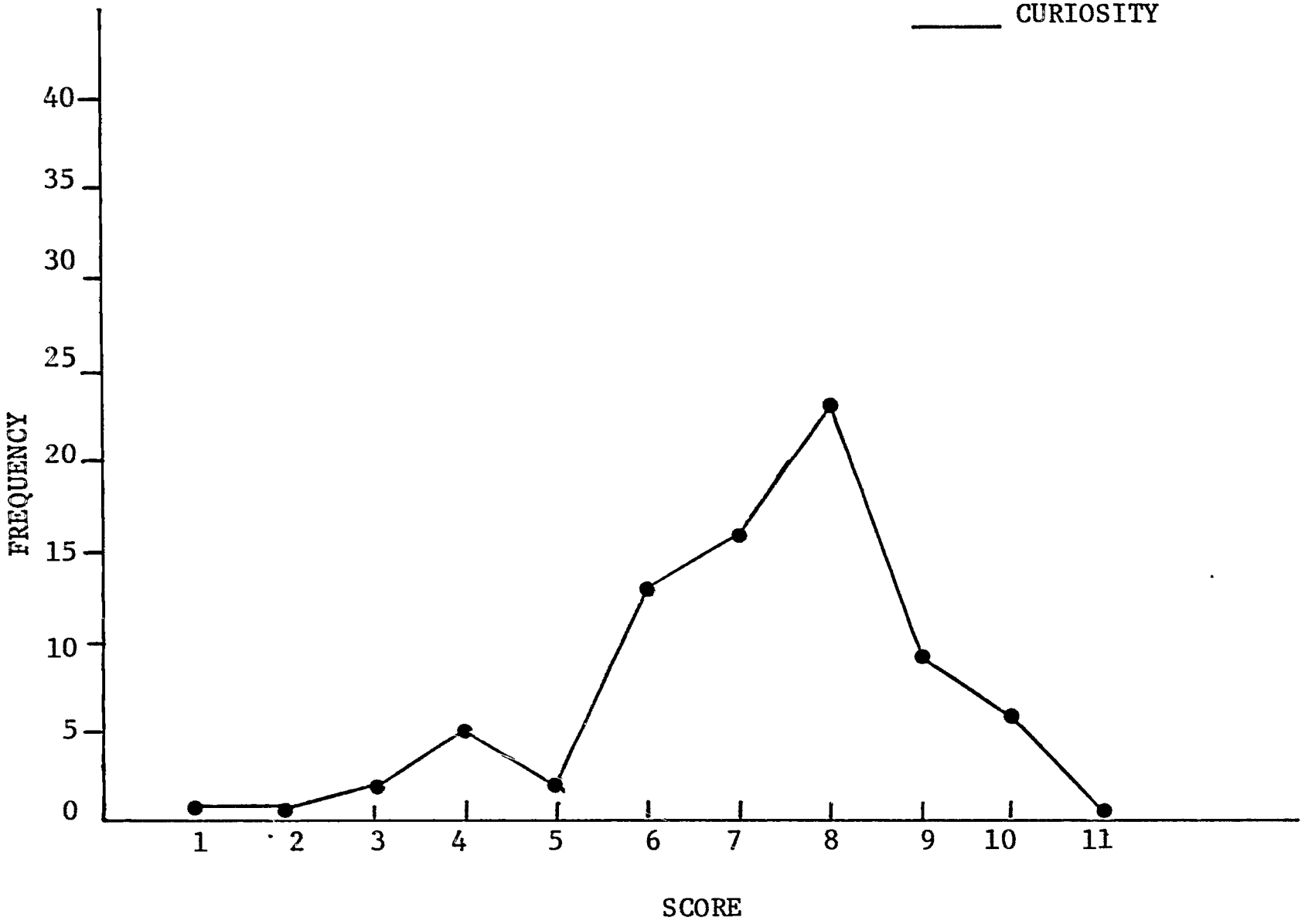

Chart 7. Distribution of Scores
on Curiosity Dimension of
The Rating Scale

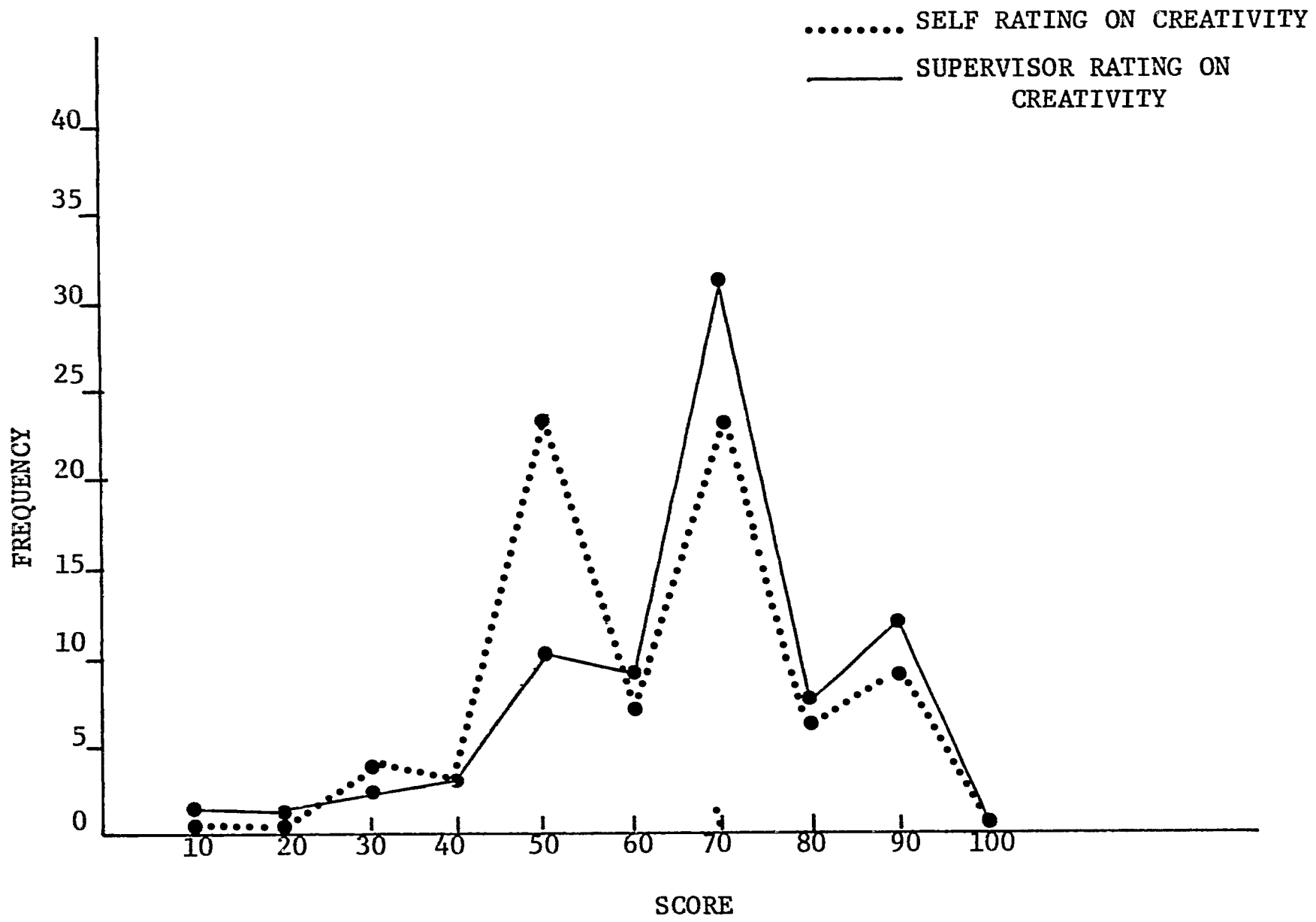

Chart 8. Distribution of Scores on Self-Rating and Supervisor's Rating on Creativity

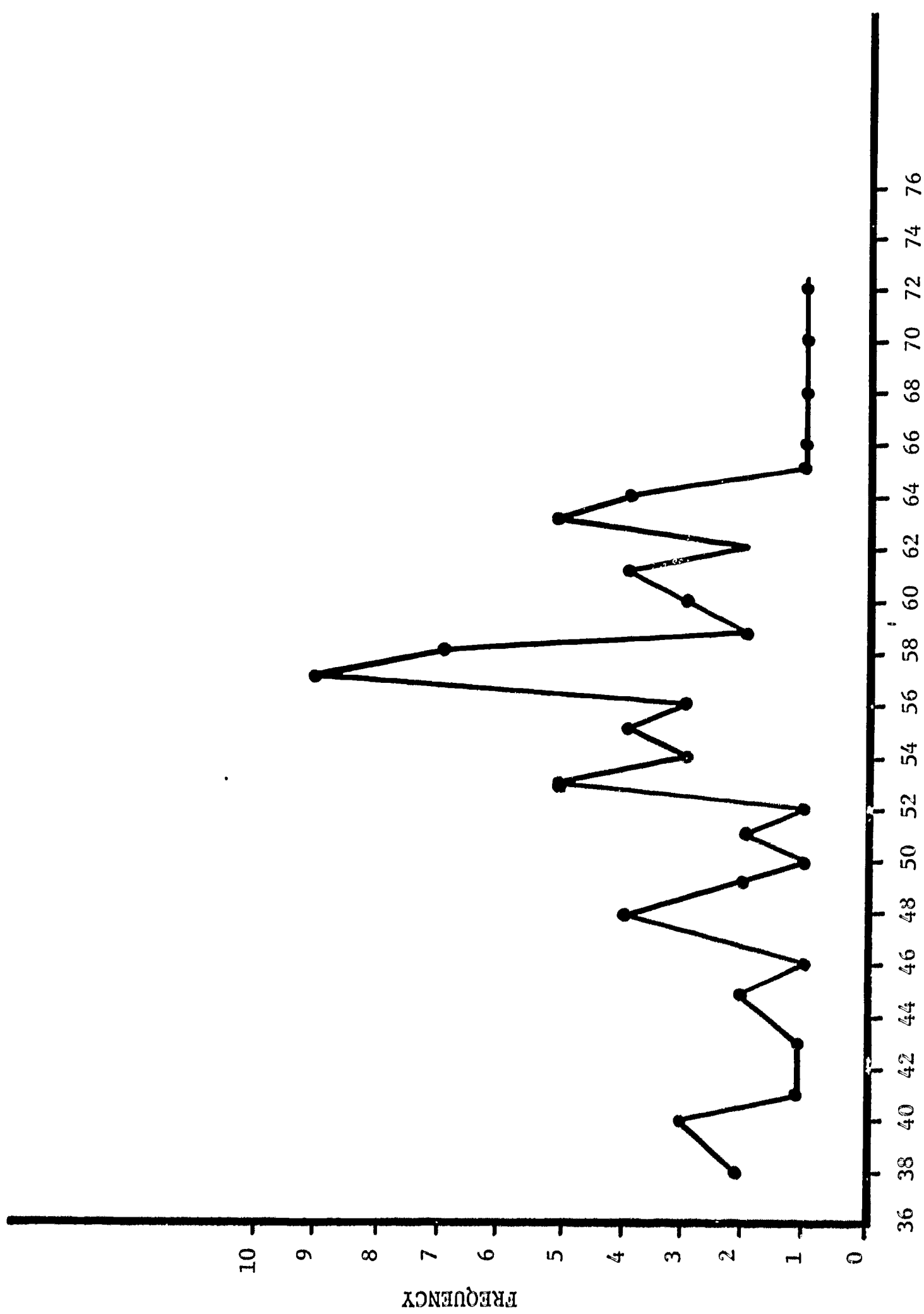

Chart 9. Distribution of Scores on the Otis Self-Administering Test of Mental Ability

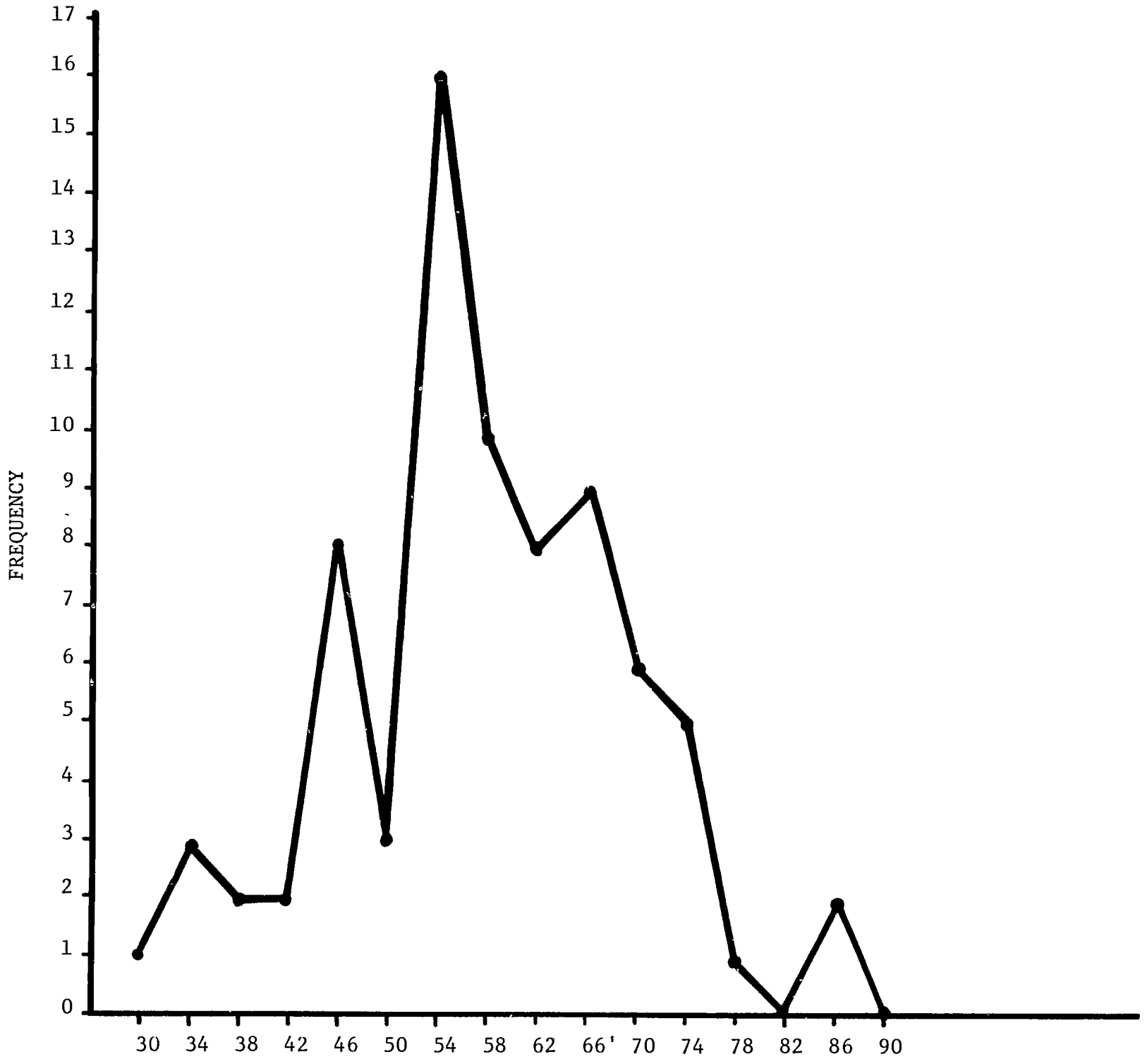

Chart 10. Distribution of Scores on the Stanford Scientific Aptitude Test

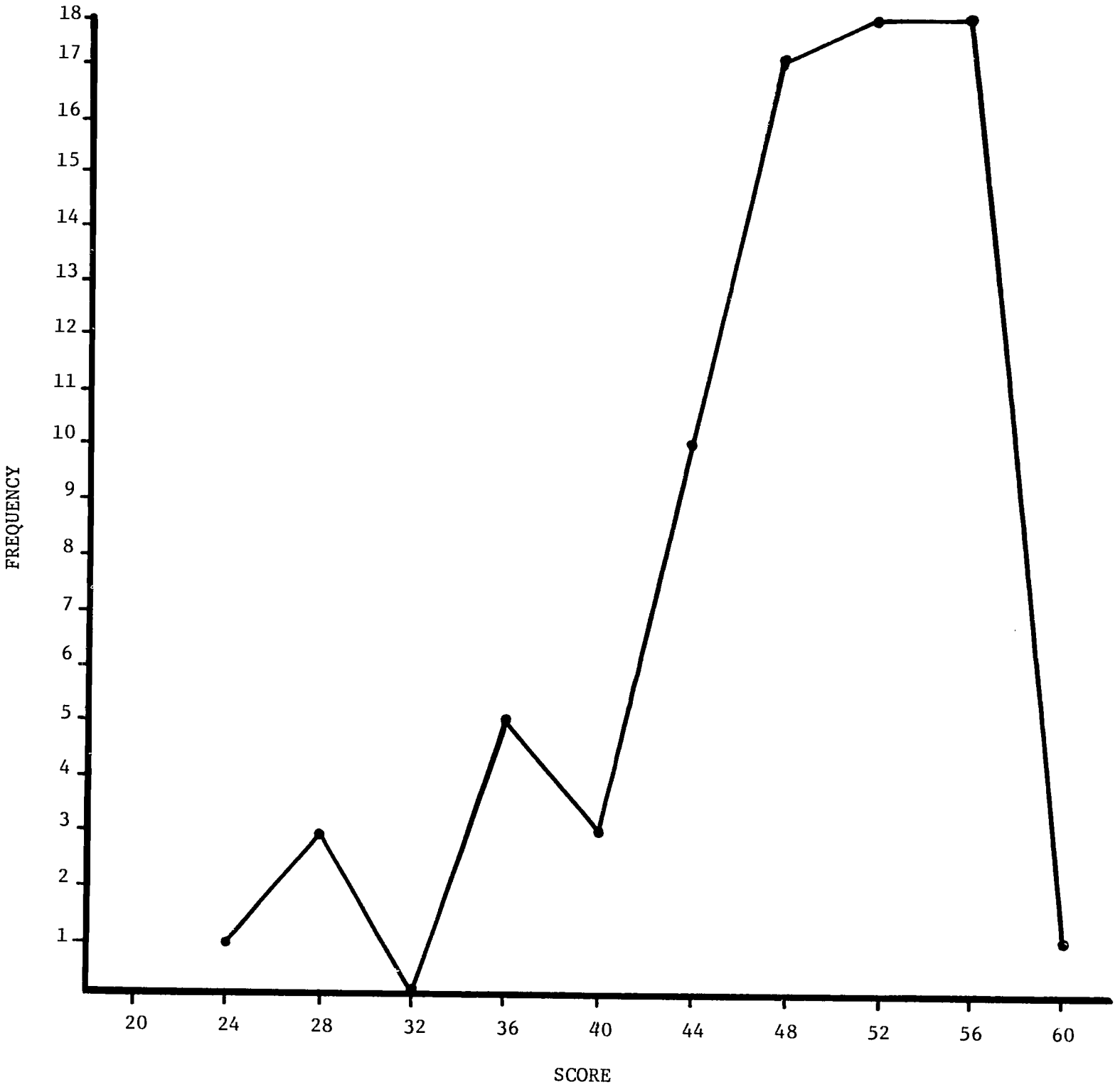

Chart 11. Distribution of Scores
on the Bennett Mechanical Comprehension Test

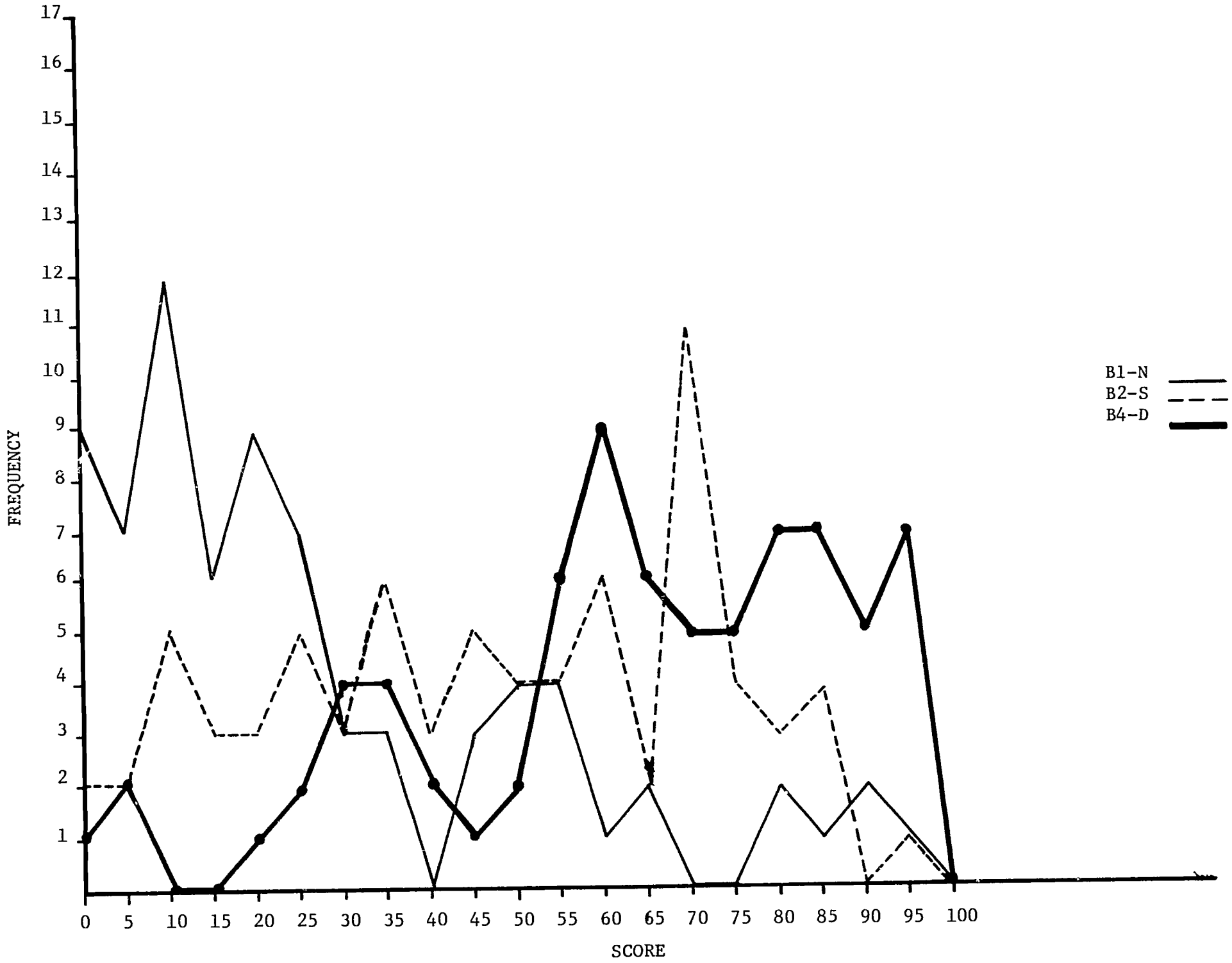

Chart 12. Distribution of Scores
on the Bernreuter Personality Inventory using Scales B1-N, B2-S, B4-D.

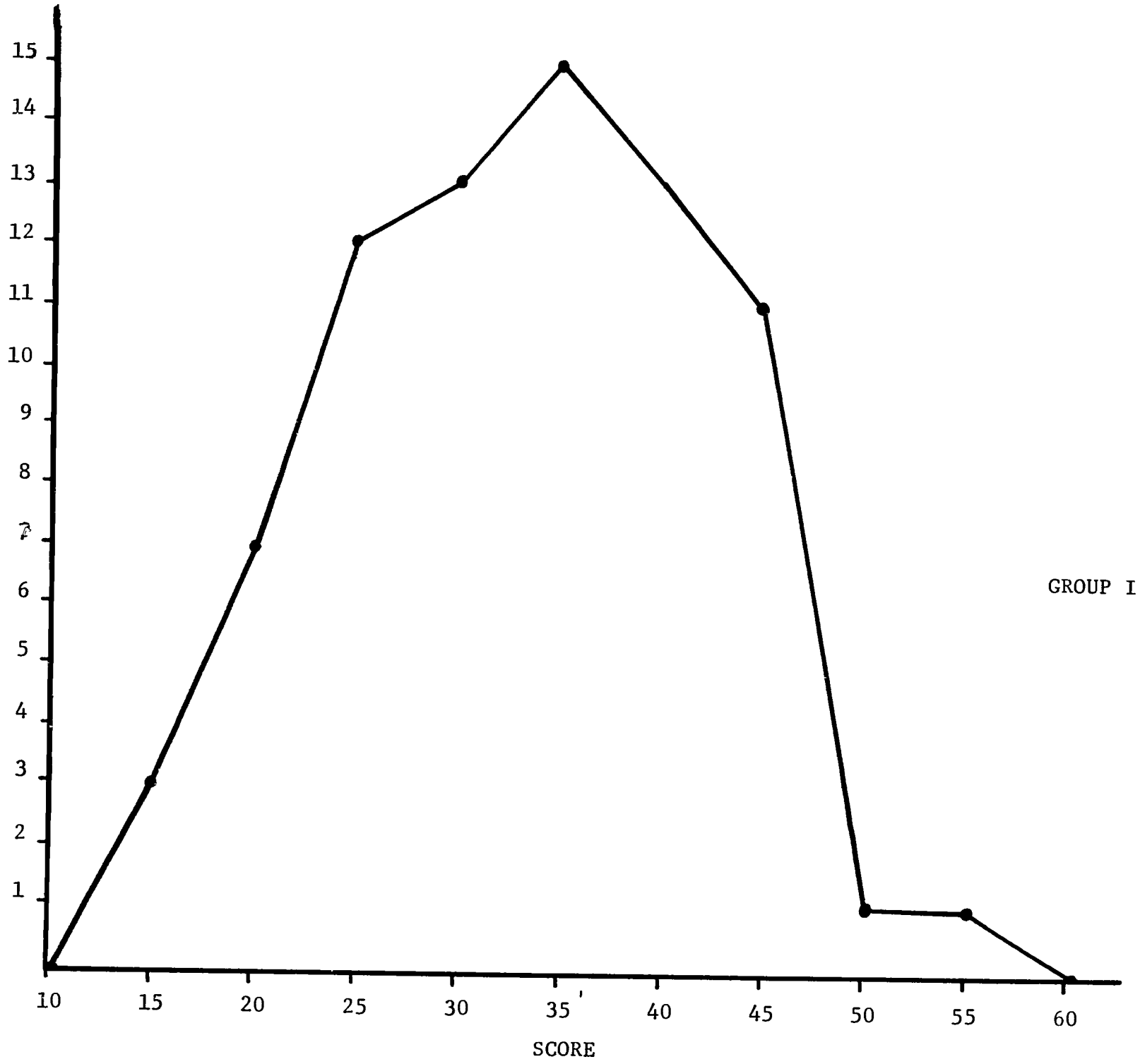

Chart 13. Distribution of Scores
for Group I of the Strong Vocational Interest Blank

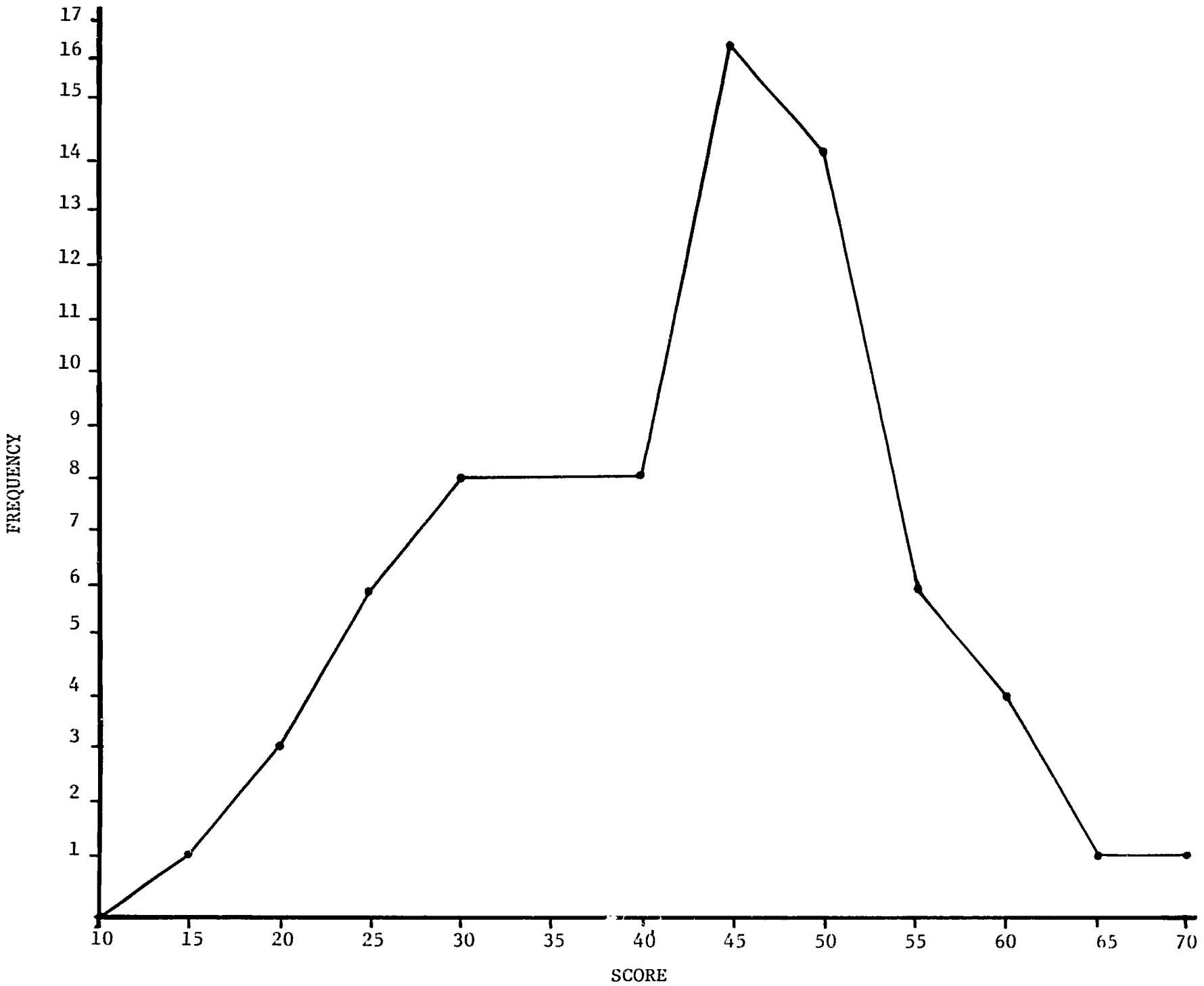

Chart 14. Distribution of Scores
for Group II of the Strong Vocational Interest Blank

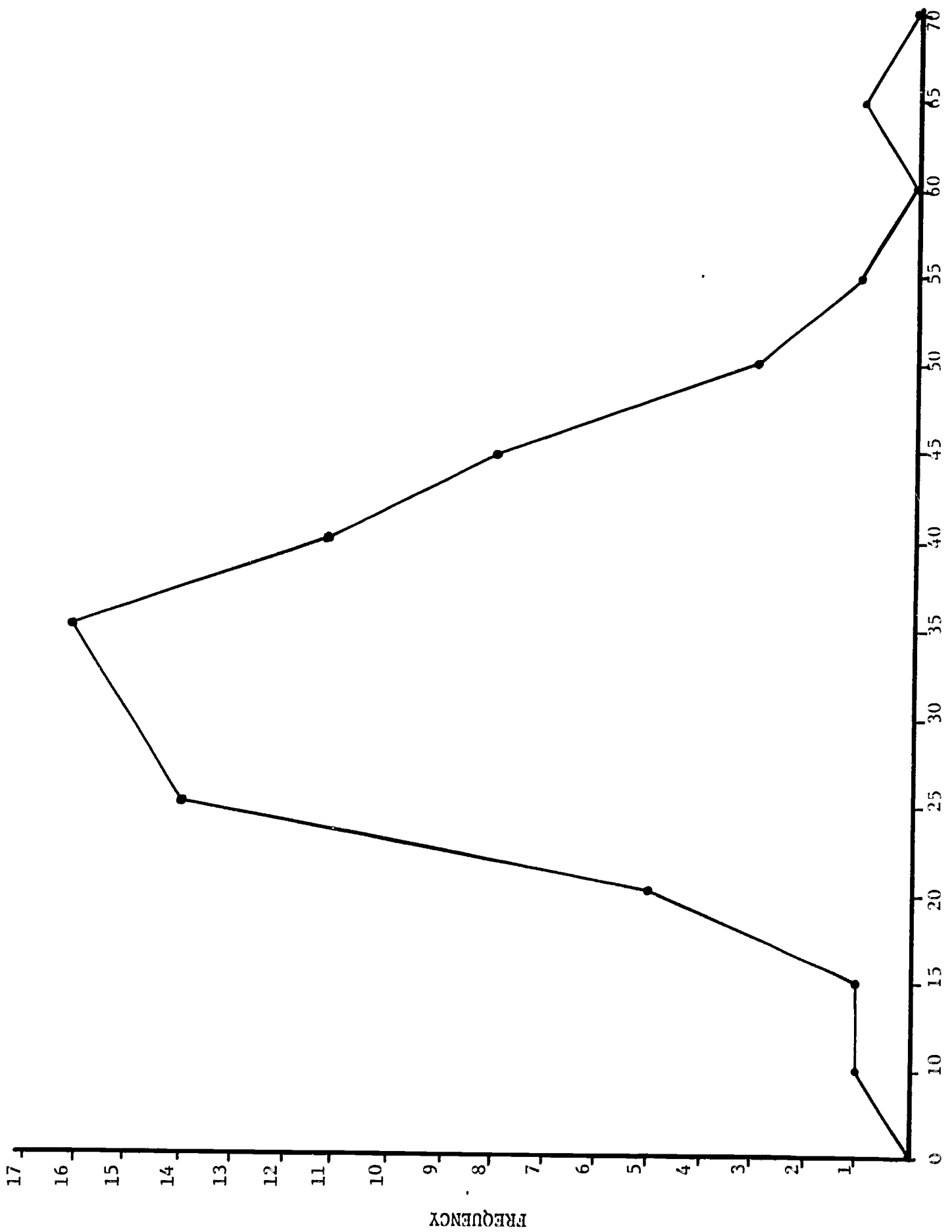

Chart 15. Distribution of Scores for Group V of the Strong Vocational Interest Blank

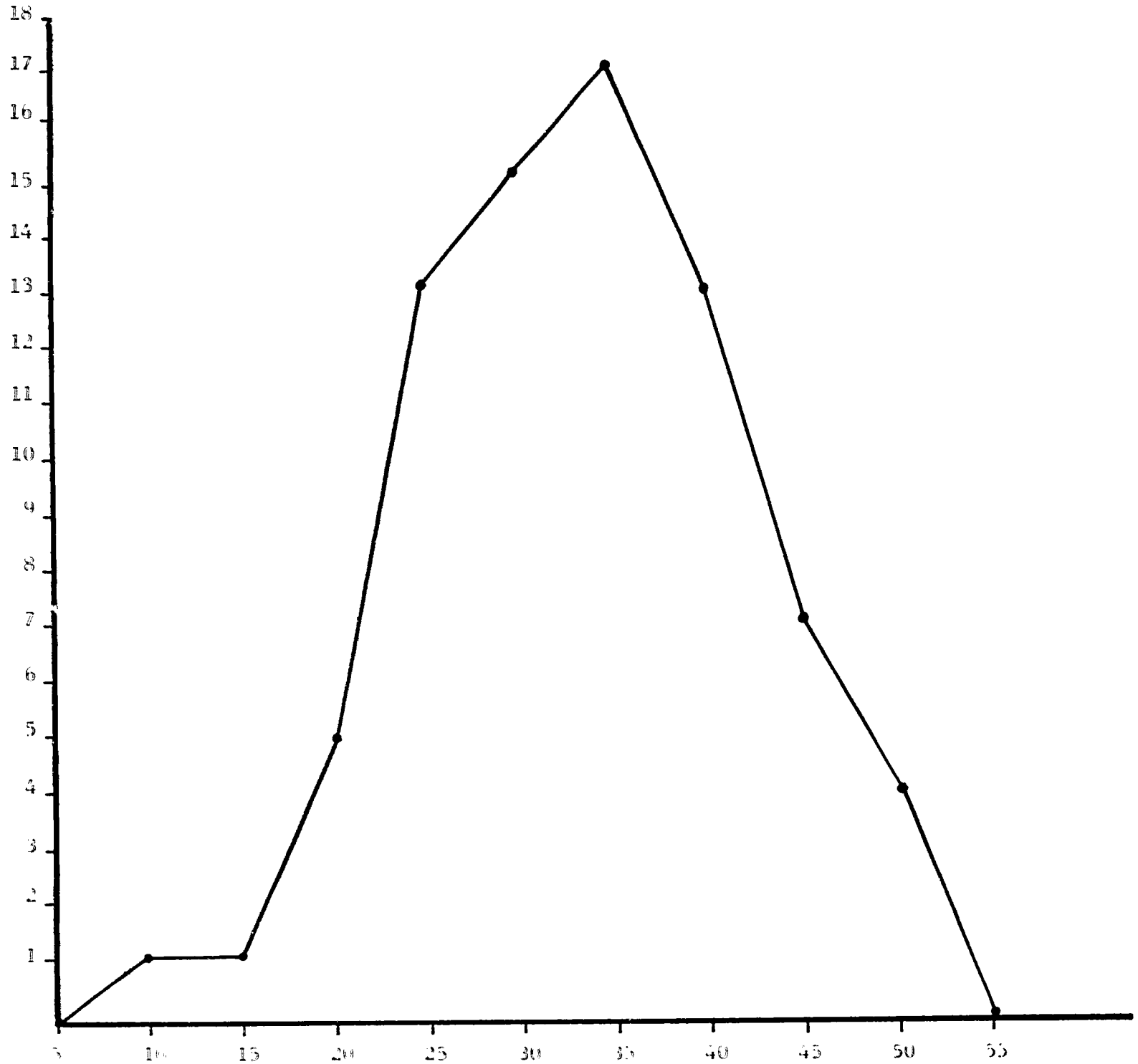

Chart 16. Distribution of Scores
for Group VIII of the Strong Vocational Interest Blank

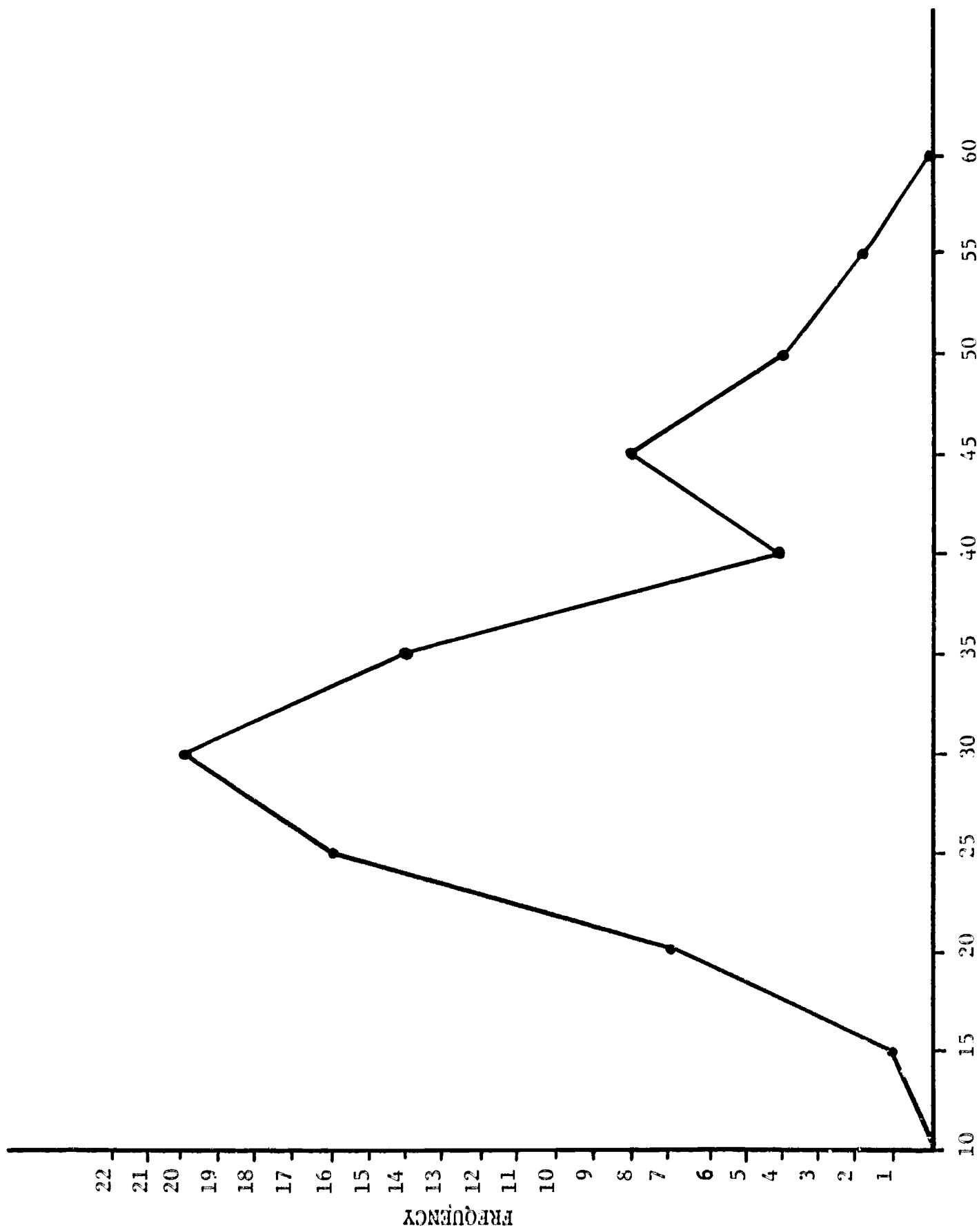

Chart 17. Distribution of Scores
for Group IX of the Strong Vocational Interest Blank

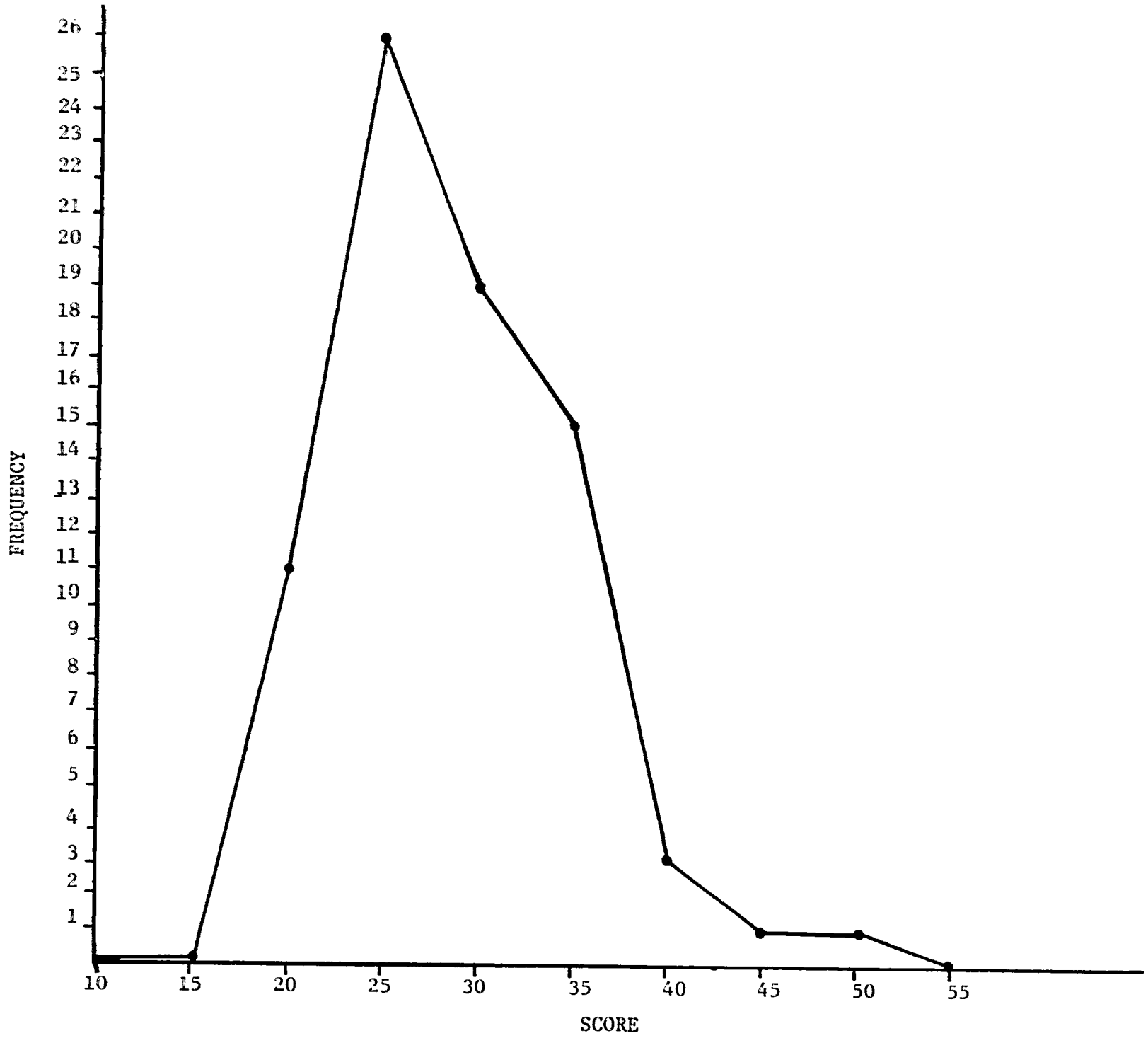

Chart 18. Distribution of Scores
for Group X of the Strong Vocational Interest Blank

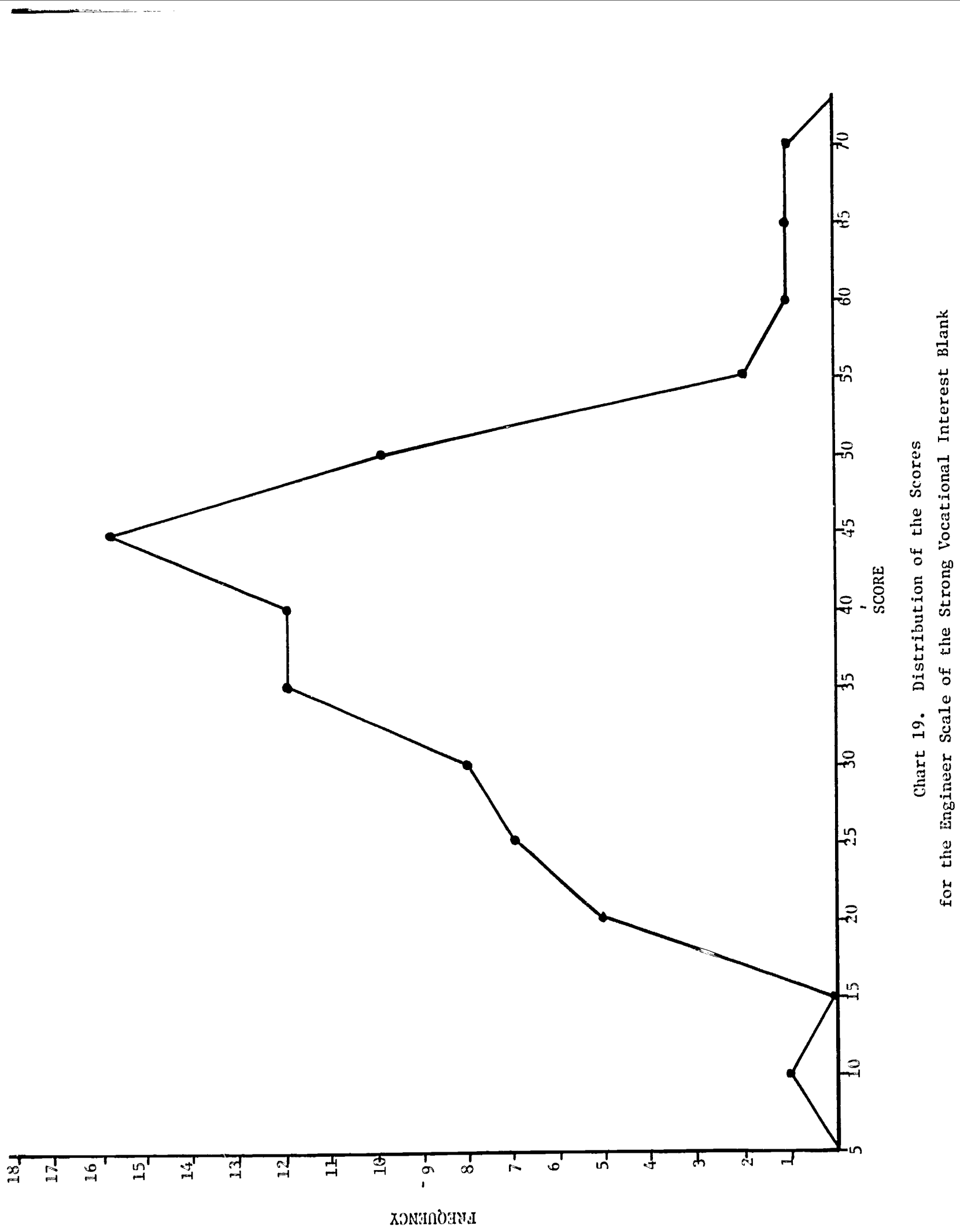

Chart 19. Distribution of the Scores for the Engineer Scale of the Strong Vocational Interest Blank

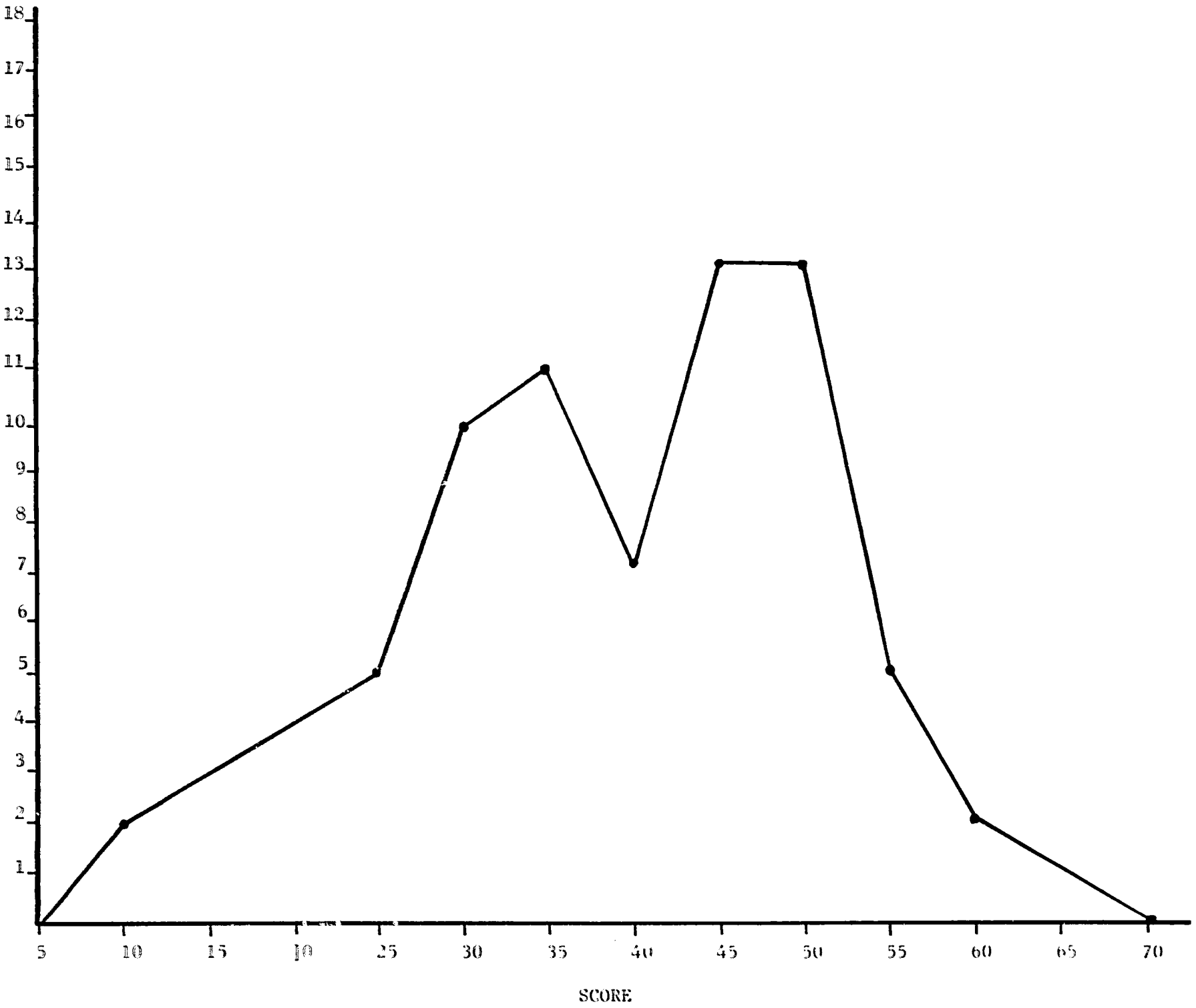

Chart 20. Distribution of the Scores
for the Chemist Scale of the Strong Vocational Interest Blank

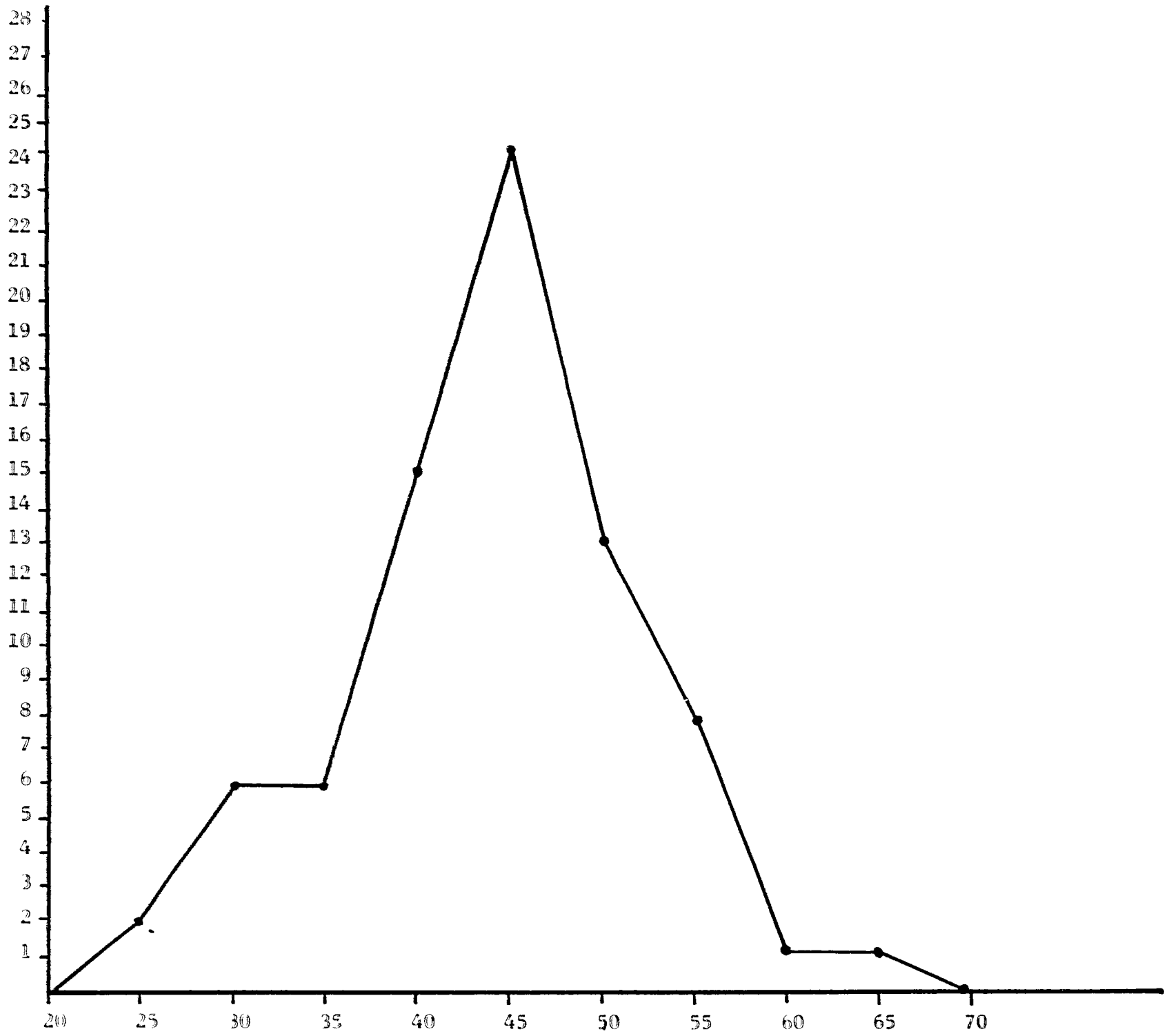

Chart 21. Distribution of the Scores
for the Production Manager Scale of the Strong Vocational Interest Blank

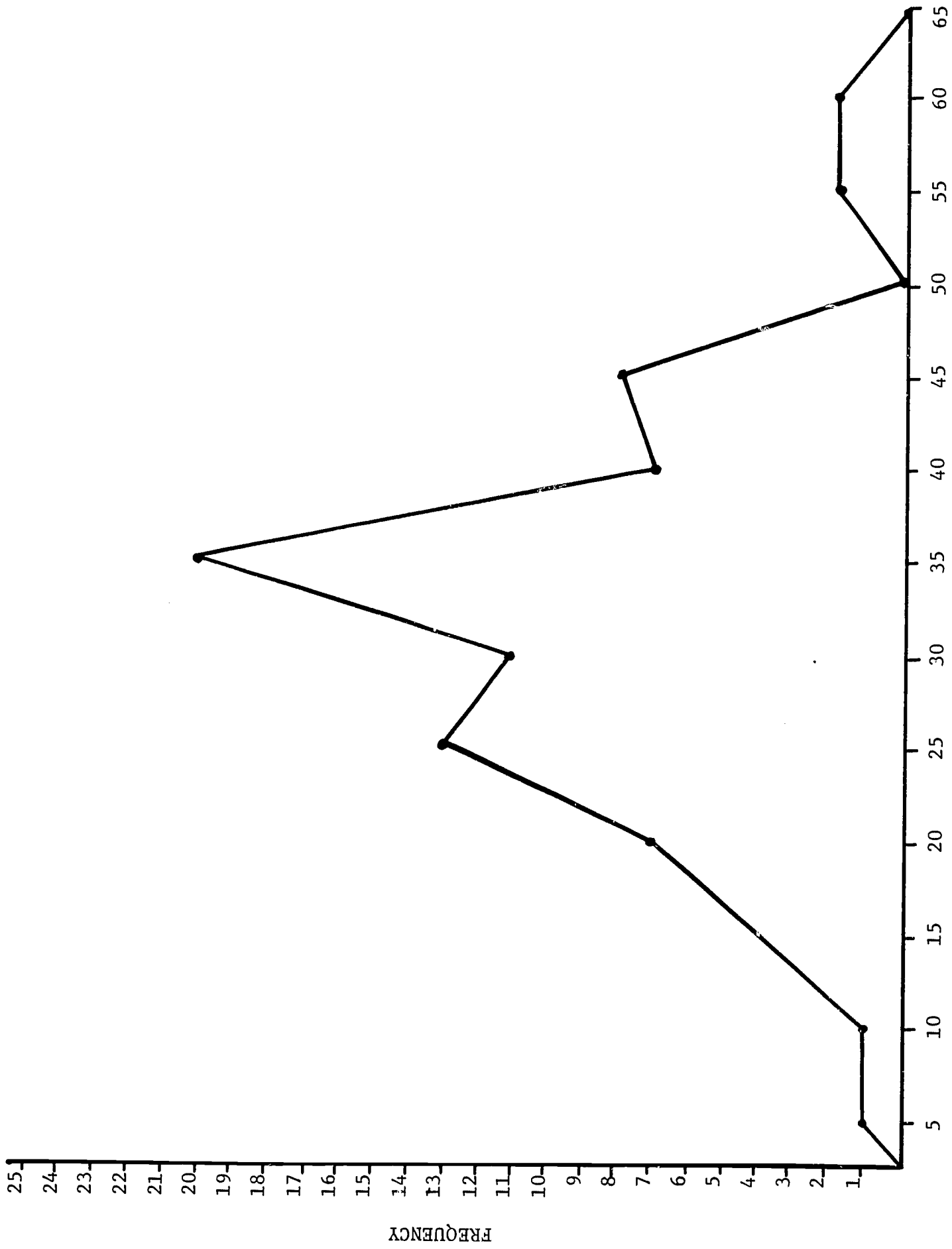

Chart 22. Distribution of the Scores for the Personnel Manager Scale of the Strong Vocational Interest Blank

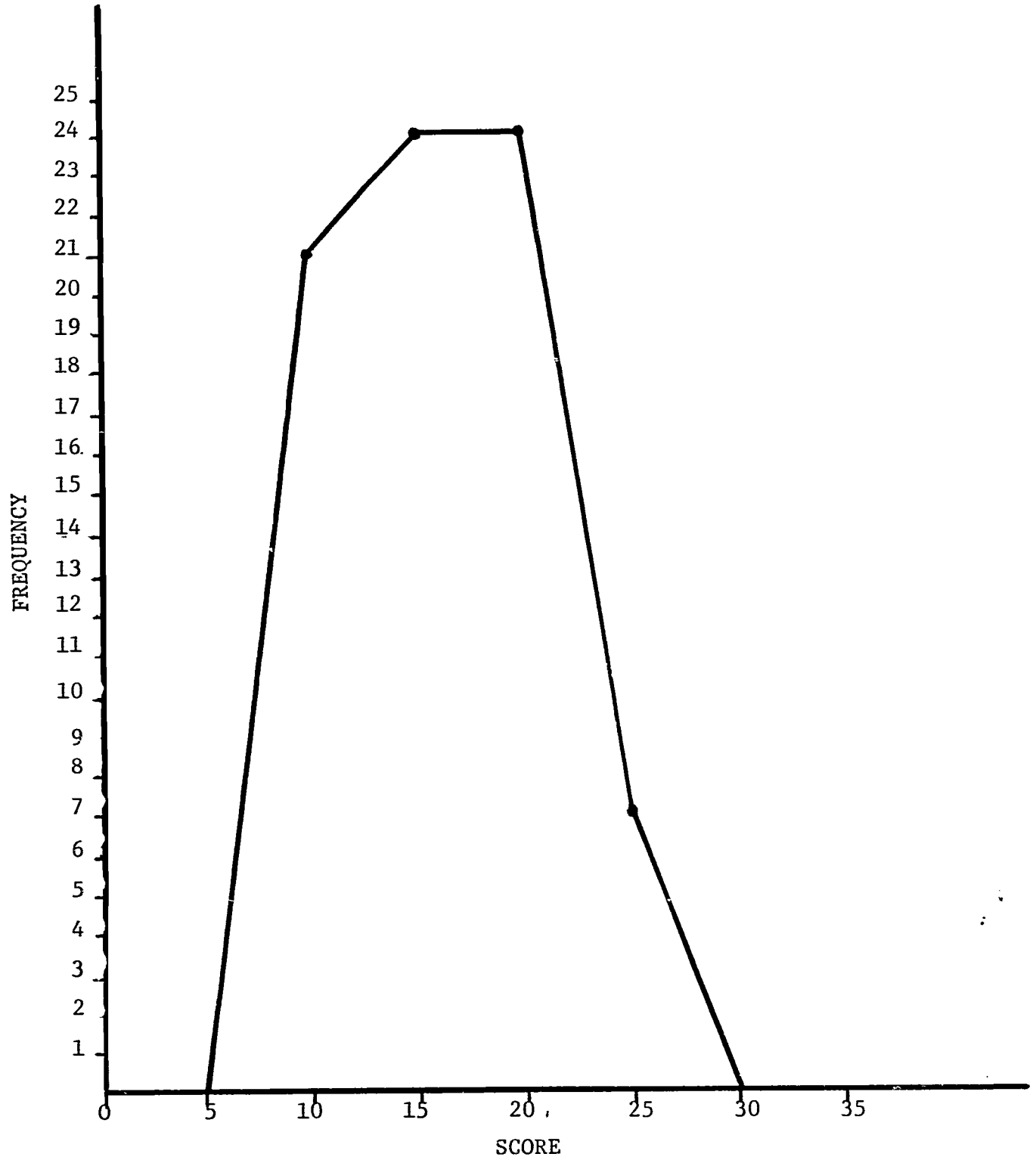

Chart 23. Distribution of Scores for the Grade Point Ratio's.

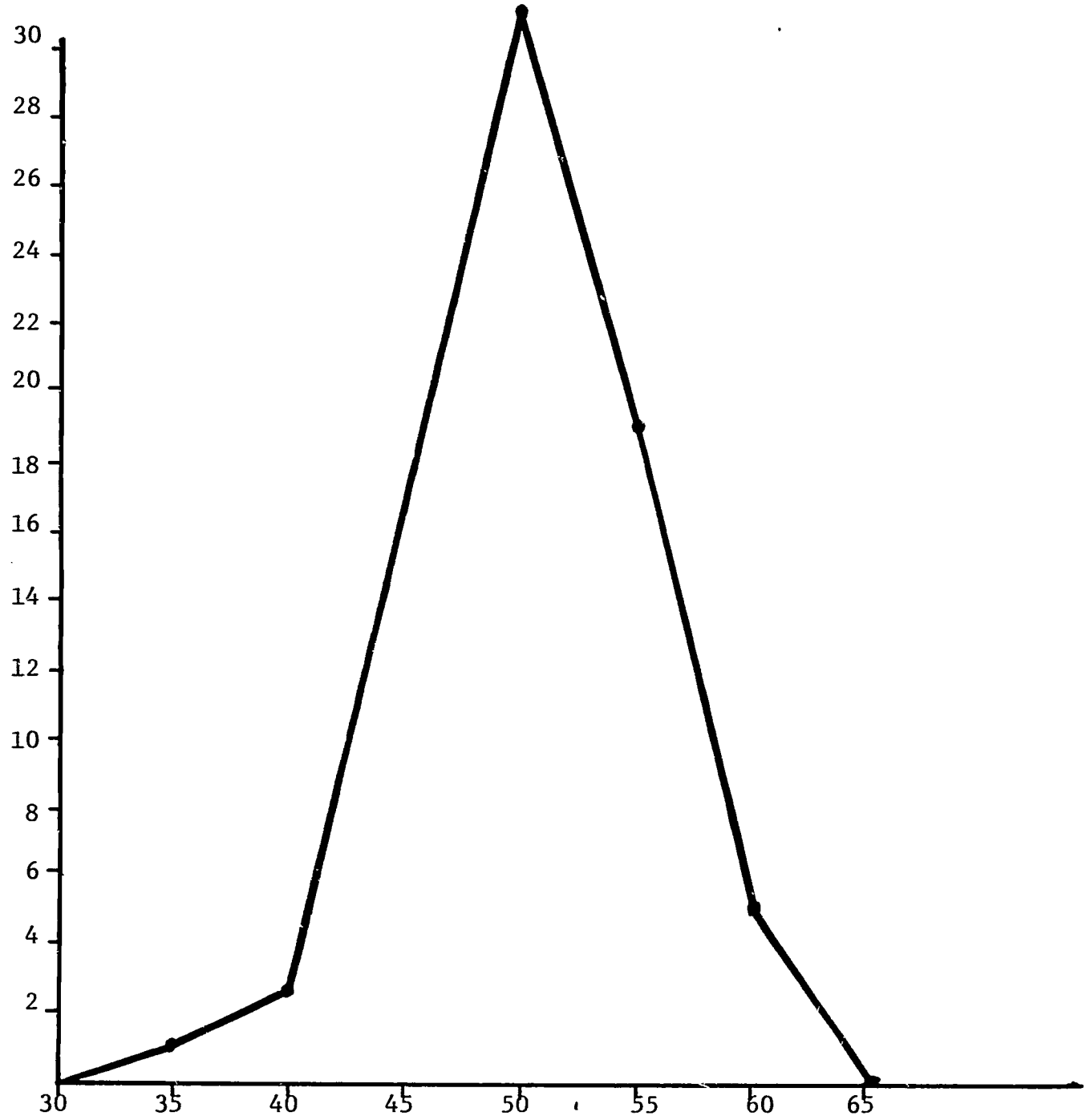

Chart 24. Distribution of Scores
for the Occupational Level Scale of the Strong Vocational Interest Blank

TABLE III

POSITION ENGINEER IS NOW IN

POSITIONS	NUMBER
Top Management	4
Middle Management	44
Senior Engineer	21
Engineer	3
Professor	3
High School Teacher	1
Totals	76

TABLE IV

Intercorrelation's of Predictor Variables

Predictor Variables	Predictor Variables																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Otis	1.000	.310**	.051	.025	-.013	-.075	.156	.018	.088	-.016	.014	.088	-.001	.143	-.180	.091	.212	-.064
2. Stanford Scient.		1.000	.462**	.009	.049	-.109	.206	.191	.068	-.172	-.192	.009	.189	.280*	-.013	.142	.266*	-.030
3. Bennett			1.000	.214	.037	-.236*	.433**	.323**	.016	-.461**	-.294**	.153	.275*	.377**	.007	-.035	.206	-.089
4. B1-N				1.000	-.342**	-.782**	.385**	.126	-.117	-.199	-.167	.173	.041	.176	-.100	-.238*	-.096	-.050
5. B2-S					1.000	.494**	-.029	.216	.024	-.102	-.173	-.079	.185	.182	.132	.062	.193	.071
6. B4-D						1.000	-.334**	-.094	.175	.131	.196	-.164	-.022	-.175	.257*	.261*	.079	.174
7. Strong I							1.000	.780**	-.293**	-.562**	-.733**	.310**	.680**	.830**	.016	-.369	.066	-.127
8. Strong II								1.000	-.509**	-.332**	-.765**	-.062	.927**	.930**	.400**	-.448**	.197	-.129
9. Strong V									1.000	.009	.172	-.103	-.570**	-.349**	-.300**	.786**	.033	-.179
10. Strong VIII										1.000	.419**	-.415**	-.243*	-.380**	.184	.058	.108	-.033
11. Strong IX											1.000	.122	-.680**	-.785**	-.123	.308**	-.019	.364**
12. Strong X												1.000	-.125	.043	.414**	.021	-.173	.398**
13. Engineer													1.000	.834**	.540**	-.442**	.191	-.081
14. Chemist														1.000	.212	-.334**	.162	-.197
15. Production Man.														.	1.000	-.101	.169	.031
16. Personnel Man.																1.000	.025	-.010
17. Grade pt. Average																	1.000	-.082
18. Occupation																		1.000

Note:
* .05 level of significance
** .01 level of significance

TABLE V

Intercorrelation's of Criterion Variables

Criterion Variables	Criterion Variables											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Creativity	1.000	.604	.718	.545	.735	.778	.604	.693	.776	.661	.510	.719
(2) Persistence		1.000	.619	.395	.543	.487	.656	.405	.613	.449	.217	.516
(3) Enthusiasm			1.000	.418	.602	.624	.624	.591	.676	.539	.414	.642
(4) Independence				1.000	.435	.433	.319	.367	.384	.353	.434	.403
(5) Fluency					1.000	.722	.598	.687	.724	.484	.497	.577
(6) Perception						1.000	.498	.653	.700	.546	.489	.732
(7) Activity							1.000	.463	.633	.528	.266	.553
(8) Flexibility								1.000	.620	.444	.480	.612
(9) Initiative									1.000	.540	.502	.697
(10) Knowledge										1.000	.374	.541
(11) Conformity											1.000	.571
(12) Curiosity												1.000

Note: The correlations between persistence and knowledge and between creativity and conformity are not significant. All others are significant at the .01 level.

TABLE VI

Correlations Between Predictor and Criterion Variables

Predictor Variables	Criterion Variables (Rating Form)												Add. Variables		
	(1) Creativity	(2) Persistance	(3) Enthusiasm	(4) Independence	(5) Fluency	(6) Perception	(7) Activity	(8) Flexibility	(9) Initiative	(10) Knowledge	(11) Conformity	(12) Curiosity	(13) Self-Rating	(14) Overall Rating	(15) Contributions
1. Otis Intelligence	-074	-132	-119	173	000	165	-165	-042	-145	-032	015	-105	-017	-003	001
2. Stanford Scientific Apt.	-213	-157	-230*	-012	-320**	-147	-354**	-231*	-263*	-214	-002	-076	055	-179	029
3. Bennett Mechanical Comp.	-069	-083	-147	016	-195	-052	-238*	-035	-158	-169	-014	025	049	-078	053
4. B1-N (Bernreuter Inv.)	-055	-063	-162	-150	-098	-037	-102	-087	-115	-036	-157	-062	-125	-052	016
5. B2-S (Bernreuter Inv.)	176	334**	265**	233*	132	146	152	130	246*	061	068	216	071	120	084
6. B4-D (Bernreuter Inv.)	102	124	269*	108	208	097	166	108	118	096	132	038	323**	064	021
7. Group I Professions	-064	-067	-189	012	-126	-084	-264*	-012	-184	-072	-074	-123	002	-060	-043
8. Group II Engineering	-009	093	-022	-011	-140	-099	-089	-004	-100	-000	-111	-137	050	-027	-002
9. Group V Personnel	-112	046	-079	042	021	-072	-046	-063	-096	-127	107	020	136	-062	106
10. Group VIII Business	-002	141	024	-123	080	-009	268*	065	031	076	-109	-042	-052	015	022
11. Group IX Sales	114	036	187	-081	224*	186	223*	038	212	125	058	146	085	078	007
12. Group X Linguistic	185	-063	062	048	150	158	-090	108	242*	055	195	248*	018	157	026
13. Engineering Scale	-056	017	-003	013	-175	-138	-106	-061	-169	-064	-098	-205	056	-106	-052
14. Chemist Scale	-052	061	-105	009	-137	-110	-196	-033	-147	-088	-125	-170	-032	-060	-036
15. Prod. Manager	-033	047	141	-105	-113	-034	105	019	-116	-053	-138	-146	190	-133	021
16. Personnel Manager	-075	-018	-055	006	-017	-031	-055	-077	-032	023	151	089	159	-057	078
17. Pt. Hour Ratio	002	223	-015	196	-048	-008	036	-144	-089	017	-019	-043	166	-061	200
18. Occupational Level	239*	136	436**	028	250*	209	229*	231*	220	205	154	204	150	166	-004

Note: * .05 level of significance
** .01 level of significance

TABLE VII

Multiple Correlations of all Eighteen Predictor Variables With Each Criterion Variable

Criterion Variable	Multiple Correlation (R)	Standard Error of Estimate	F Value	Significance
1. Creativity	0.4280	2.4241	0.7106	N.S.
2. Persistence	0.5838	1.5775	1.6378	$P < .10$
3. Enthusiasm	0.6073	1.7207	1.8506	$P < .05$
4. Independence	0.4686	1.5878	0.8914	N.S.
5. Fluency	0.5048	1.5326	1.0831	N.S.
6. Perception	0.4519	1.7163	0.8127	N.S.
7. Activity	0.5644	1.5910	1.4807	N.S.
8. Flexibility	0.4509	1.8388	0.8084	N.S.
9. Initiative	0.5875	1.7305	1.6693	$P < .10$
10. Knowledge	0.4589	1.3782	0.8451	N.S.
11. Conformity	0.3980	1.8119	0.5961	N.S.
12. Curiosity	0.5093	1.6370	1.1091	N.S.
13. Average of 12 Variables	0.4790	0.7711	0.9434	N.S.
14. Self-Rating	0.5510	16.8320	1.3830	N.S.
15. Overall Rating of Creativity	0.4110	17.8160	0.6430	N.S.
16. Contributions				

TABLE VIII

Combination of Predictor Variables Against The Average of the Twelve Criterion Variables

Predictor Variables	R	S.E. Est.	F	Significance
Stanford Scientific Apt. (2)	0.2764	0.7410	6.1228	$p < .05$
Stanford Scientific Apt. (2) Occupational Level (18)	0.3615	0.7238	5.4884	$p < .01$
Stanford Scientific Apt. (2) Bern. Self-Sufficiency (5) Occupational Level (18)	0.4273	0.7066	5.3638	$p < .01$
Stanford Scientific Apt. (2) Bern. Self-Sufficiency (5) Strong Engineer (13) Occupational Level (18)	0.4373	0.7078	4.1989	$p < .01$
Stanford Scientific Apt. (2) Bern. Self-Sufficiency (5) Strong (Group II) (8) Strong Engineer (13) Occupational Level (18)	0.4528	0.7068	3.6119	$p < .01$

Combination of Predictor Variables Against The Average of the Twelve Criterion Variables

Predictor Variables	R	S.E. Estimate	F	Significance
Stanford Scientific Apt. (2) Bern. Self-Sufficiency (5) Strong (Group II) (8) Strong (Group IX) (11) Strong Engineer (13) Occupational Level (18)	0.4580	0.7098	3.0531	$p < .05$
Variables, 2,5,8,11 13, and 18 plus - Bernreuter - Neuroticism (4)	0.4608	0.7138	2.6201	$p < .05$
Variables 2,4,5,8,11, 13 and 18 plus - Bernreuter - Domnance (6)	0.4648	0.7174	2.3088	$p < .05$
Variables 2,4,5,6,8,11, 13, and 18, plus - Grade-Point Average (17)	0.4669	0.7219	2.0452	$p < .05$
Variables 2,4,5,6,8,11, 13, 17, and 18 plus - Strong (Group X) (12)	0.4687	0.7267	1.8309	$p < .10$

TABLE IX

Combination of Criterion Variables Against Total Biographical Score (Step-Wise Method)

Criterion Variable	R	S.E. Est.	F	Significance
Self-Evaluation of (14) Creativity	0.5956	8.4186	40.6940	$p < .01$
Self-Evaluation (Creativity) (14) Curiosity (12)	0.6674	7.8581	29.3197	$p < .01$
Self-Evaluation (Creativity) (14) Curiosity (12) Creativity (1)	0.6803	7.7874	20.6800	$p < .01$
Self-Evaluation (Creativity) (14) Curiosity (12) Creativity (1) Ability to Perceive (6)	0.7089	7.5458	17.9407	$p < .01$
Self-Evaluation (Creativity) (14) Curiosity (12) Creativity (1) Ability to Perceive(6) Independence (4)	0.7310	7.3530	16.0696	$p < .01$

TABLE IX Con't.

Combination of Criterion Variables Against
Total Biographical Score (Step-Wise Method)

Criterion Variable	R	S.E. Est.	F	Significances
Self-Evaluation (Creativity) (14) Curiosity (12) Creativity (1) Ability to Perceive (6) Independence (4) Persistence (2)	0.7427	7.2679	14.1481	$p < .01$
Variables (14), (12), (1), (6), (4), and (2), plus - conformity (11)	0.7488	7.2461	12.4024	$p < .01$
Variables (14), (12), (1), (6), (4) (2) and (11), plus - flexibility (8)	0.7528	7.2495	10.9588	$p < .01$
Variables (14), (12), (1), (6), (4) (2), (11), and (8), plus - knowledge (10)	0.7564	7.2585	9.8097	$p < .01$
Variables (14), (12), (1), (6), (4), (2), (11), (8), and (10), plus - (13) Overall Rating on Creativity	0.7580	7.2932	8.7822	$p < .01$

TABLE IX (Con't)

Combination of Criterion Variables Against
Total Biographical Score (Step-Wise Method)

Criterion Variable	R	S.E. Est.	F	Significance
Variables (14), (12), (1), (6), (4), (2), (17), (8), (10), and (13), plus - (9) Initiative	0.7599	7.3253	7.9534	$p < .01$
Variables (14), (12), (1), (6), (4), (2), (11), (8), (10), (13), and (9) plus - (15) Number of Contributions	0.7610	7.3684	7.2265	$p < .01$
Variables (14), (12), (1), (6), (4) (2), (11), (8), (10), (13), (9), and (15) plus - (3) Enthusiasm	0.7622	7.4122	6.6120	$p < .05$
Variables (14), (12), (1), (6), (4), (2), (11), (8), (10), (13), (9), (15) and (3), plus - (5) Fluency	0.7628	7.4643	6.0640	$p < .05$
Variables (14), (12), (1), (6), (4), (2), (11), (8), (10), (13), (9), (15) (3) and (5) plus - (7) Activity	0.7628	7.5260	5.5676	$p < .05$

TABLE X

Table of Variables Isolated by the Step-Wise Method Showing Maximum Correlation with the "Creativity" Dimension of the Rating Form

PREDICTOR VARIABLES	Betas	Standard Error	"F"	Significance Levels
2. Stanford Scientific Aptitude Test	-0.251	0.117	4.581	Significant at .05 Level
5. Berneuter "self sufficiency" scale	0.201	0.115	3.072	N.S.
9. Strong Group V	-0.305	0.152	4.007	Significant at .05 Level
12. Group X	0.134	0.117	1.321	N.S.
13. Engineer Scale	-0.272	0.253	1.159	N.S.
14. Chemist Scale	0.161	0.222	0.523	N.S.
19. Professional Self-Confidence Score	0.263	0.263	0.994	N.S.
21. Correction Score	0.205	0.137	2.230	N.S.
22. Total Score	0.188	0.244	0.590	N.S.

$R = 0.5234$

$F = 2.7670$ ($p < .01$)

TABLE XI

Table of Variables Isolated by the Step-Wise Method Showing Maximum Correlation with the "Contribution" Dimension

PREDICTOR VARIABLE	BETAS	STANDARD ERROR	"F"	SIGNIFIENCE LEVELS
4. Bernreuter "Neuroticism" scale	0.079	0.114	0.474	N.S.
17. Grade point average	0.156	0.115	1.856	N.S.
20. "Overall Creativity" rating	0.243	0.117	4.342	Significant at the .05 level

R = 0.3093

F = 2.5402 ($p < .10$)

TABLE XII

Table of Correlations of the Ellison-Taylor Biographical Inventory with the "Creativity" Dimension of the Rating Form

Predictor Variables	Betas	Standard Error	"F"	Significance Level
19. Professional Self Confidence Score	0.559	0.337	2.748	N.S.
20. Creativity Score	0.501	0.470	1.138	N.S.
21. Correction Score	0.349	0.219	2.524	N.S.
22. Total Score	0.591	0.619	0.912	N.S.

R = 0.3299

F = 2.1683 ($p < .10$)

TABLE XIII

Table of Correlations of the Taylor-Ellison Biographical Inventory with the "Contribution" Dimension

PREDICTOR VARIABLE	BETAS	STANDARD ERRORS	"F"	SIGNIFIENCE LEVELS
19. Professional Self Confidence Score	0.223	0.342	0.423	N.S.
20. Creativity Rating Score	0.545	0.477	1.306	N.S.
21. Correction Score	0.230	0.222	1.072	N.S.
22. Total Score	-0.382	0.627	0.371	N.S.

R = 0.2887

F = 1.6144 (Not significant)

TABLE XIV

Relationship of Biographical Inventory to the Criterion Measures of Creativity and Contributions

Taylor-Ellison Biographical Inventory	Creativity	Contributions
1. Prof. Self-Confidence	.268*	.204
2. Overall Creativity Score	.233*	.260*
3. Correction Score	-.005	-.028
4. Overall Weighted Score	.265*	.255*

* $p < .05$
** $p < .01$

Note: The multiple correlation between professional self-confidence with overall creativity and the creativity dimension of the rating form was 0.2704. The multiple correlation with contributions was 0.2604.

TABLE XV

Intercorrelations of Taylor-Ellison-Biographical Sub-Parts and Total Scores

VARIABLES	OVERALL CREATIVITY	CORRECTION SCORE	TOTAL SCORE
1. Professional Self-Confidence	0.7815**	-0.5007**	0.8594**
2. Overall Creativity		-.4513**	0.9275**
3. Correction Score			-0.2585**

Note: These correlations are all significant at the .01 level.

TABLE XVI

Table of Relationships Between Dependent (Criterion) Variables and the Total Score on the Biographical

Criterion Variables (Dependent)	r	Beta	SE Beta	F	Significance
1. Creativity in Man's Work	.2645	-.5353	.2139	6.262	$p < .05$
2. Persistence in Work	.3163	.2042	.1272	2.579	N.S.
3. Enthusiasm for Work	.3383	.0729	.1446	0.254	N.S.
4. Independence in his Work	.2908	.1272	.1082	1.381	N.S.
5. Fluency of Ideas and Sugges-tions	.2811	-.0534	.1561	0.117	N.S.
6. Ability to Perceive Unusual	.4708	.4142	.1665	6.187	$p < .05$
7. Activity Level	.2118	-.0092	.1403	0.004	N.S.
8. Flexibility in Work Habits	.2007	-.0927	.1367	0.460	N.S.
9. Intiative	.2701	-.1135	.1638	0.480	N.S.
10. Knowledge of Work	.1878	-.1246	.1176	1.123	N.S.
11. Tendency Toward Conformity	.3203	.1446	.1198	1.455	N.S.
12. Curiosity	.3805	.2072	.1539	1.814	N.S.
13. Overall Rating on Creativity	.3497	.1776	.2170	0.670	N.S.
14. Self-Rating on Creativity	.5956	.4845	.0998	23.549	$p < .01$
15. Number of Contributions	.2547	.0628	.1096	0.329	N.S.

$R = 0.7628$ SE Est = 7.5260 df = 60 $F = 5.5676$ $p < .01$

TABLE XVII

Rotated Factors of Eighteen Predictor Variables

Variable	I Professions Engineering Business	II Personality	III Personnel	IV Linguistic Occupational	V Academic	VI Intelligence	VII Production Manager	h^2
1. Otis Intelligence	.0723	.0239	-.0737	.0119	-.1525	**-.9070**	.1425	.8776
2. Stanford Scientific	.2420	.1185	-.3293	.1366	**-.6002**	-.3123	-.1671	.6854
3. Bennett Mech. Comp.	.4137	.2278	-.2056	.1751	**-.6501**	.2200	.0629	.7709
4. BI-N (Neuroticism)	.1570	**.7807**	.1655	-.0010	-.0894	.0951	.2410	.7366
5. B2-S (Self-Sufficiency)	.1869	**-.7841**	.0785	-.0414	-.2286	.1251	.1913	.7621
6. B4-D (Dominance)	- .1311	**-.8768**	-.1571	.0724	.1021	.0153	-.2027	.8677
7. I (Professions)	**.8798**	.2337	.1309	.1223	-.0792	-.0980	.1343	.8947
8. II (Engineering)	**.8773**	-.0552	.3201	-.0493	-.1371	-.0159	-.2349	.9518
9. V (Personnel)	- .2622	-.0976	**-.8201**	-.2303	-.0387	-.0161	.2499	.8681
10. VIII (Business)	**-.6062**	-.0495	.2159	-.3655	.0829	-.2102	-.3874	.7512
11. IX (Sales)	**-.8815**	-.0283	-.0333	.2849	-.0062	-.0625	-.0412	.8657
12. X (Linguistic)	.1043	.1230	.0006	**.7495**	.0656	-.0799	.4599	.8099
13. Engineering	**.7973**	-.0832	.3401	-.0179	-.1208	-.0184	-.4108	.9424
14. Chemist	**.9130**	.0116	.1659	-.0525	-.1396	-.1342	-.0824	.9082
15. Production Manager	.1762	-.1920	.1373	-.0748	-.0726	.1634	**-.8426**	.8343
16. Personnel Manager	- .2762	-.1736	**-.8457**	.0171	-.0452	-.0773	-.0153	.8302
17. Point Hour Ratio	- .0368	-.2106	.1833	-.2283	**-.7761**	-.1973	-.0377	.7741
18. Occupational Level	- .2377	-.1399	.1689	**.8193**	-.0071	.0258	-.1331	.7942

TABLE XVIII

Rotated Factors of the Criterion Variables

Variable	I Activity	II Creativity	III Independence	IV Knowledge	h^2
1. Creativity	.4744	-.6282	.2817	.3679	.8344
2. Persistence	.8439	-.1955	.2154	.1238	.8122
3. Enthusiasm	.5877	-.4860	.1717	.2894	.6948
4. Independence	.2445	-.2110	.9176	.1025	.9568
5. Fluency	.4653	-.7273	.1766	.0524	.7794
6. Perception	.3331	-.7360	.1556	.2774	.7537
7. Activity	.7713	-.2855	.0351	.2765	.7542
8. Flexibility	.2770	-.8139	.0830	.0664	.7505
9. Initiative	.5209	-.6570	.1002	.2474	.7743
10. Knowledge	.3329	-.2498	.1191	.8485	.9073
11. Conformity	-.1647	-.6740	.4176	.3185	.7573
12. Curiosity	.3121	-.6602	.1512	.4162	.7293

Notes: (1) % accounted for = .7920

(2) Eigenvalues 7.1451
1.0177
.7431
.5984

TABLE XIX

Creativity Research - Canonical Correlation and Coefficients

Predictor Variables		Criterion Variables	
Variables	Canonical Coefficient	Variable	Canonical Coefficient
1. Otis Intelligence	-.2081	1. Creativity	.1296
2. Stanford Scientific	.1847	2. Persistence	.0113
3. Bennett Mech. Comp.	.0363	3. Enthusiasm	-.4785
4. BI-N (Neuroticism)	-.1944	4. Independence	.0286
5. B2-S (Self-sufficiency)	.2076	5. Fluency	-.1781
6. B4-D (Domiance)	-.3192	6. Perception	-.3099
7. I (Professions)	.1021	7. Activity	-.2079
8. II (Engineering)	.6400	8. Flexibility	-.0765
9. V (Personnel)	-.2938	9. Initiative	.4739
10. VIII (Business)	.1054	10. Knowledge	-.0168
11. IX (Sales)	-.0808	11. Conformity	-.0545
12. X (Linguistic)	.2767	12. Curiosity	.5905
13. Engineering	-.3762		
14. Chemist	-.5347		
15. Production Manager	-.1627		
16. Personnel Manager	.3144		
17. Point Hour Ratio	-.0257		
18. Occupational Level	-.3034		

$R_C = .8234$ $x^2 = 251.03$

df = 216

$p < .05$

TABLE XX

A Statistical Comparison of Chemical Engineers who completed all forms with those who did not complete them.

	Completed N=76		Incomplete N=52		
Variable	Mean	S.D.	Mean	S.D.	"t"
(1) Otis Intell.	55.57	7.49	55.02	8.96	.3741
(2) Stanford Sci. Apt.	59.04	11.70	55.79	15.75	1.3394
(3) Bennett Mech. Comp.	49.71	7.63	47.75	8.10	1.3920
(4) B1-N	29.16	25.04	33.50	23.91	.9812
(5) B2-S	49.09	24.86	52.81	28.74	.7790
(6) B4-D	65.49	23.82	67.19	26.31	.3812
(7) Strong I	35.36	8.75	35.10	10.33	.1528
(8) Strong II	44.57	11.26	42.52	12.27	.9738
(9) Strong V	35.57	9.11	37.08	9.62	.9013
(10) Strong VIII	35.54	8.41	35.46	8.04	.0524
(11) Strong IX	34.29	9.09	35.40	10.51	.6389
(12) Strong X	30.94	5.85	32.52	8.18	1.2785
(13) Engineer	40.74	11.09	38.19	13.17	1.1809
(14) Chemist	40.62	12.44	38.15	14.47	1.0297
(15) Pro. Manager	45.63	7.94	43.67	7.97	1.3686
(16) Personnel Manager	34.24	10.66	35.12	11.64	.4411
(17) Grade Pt. ratio	17.76	4.60	16.75	4.04	1.2852
(18) Occupational Level	52.57	4.93	53.02	6.17	.4611

Note: These "t" values were not statistically significant.